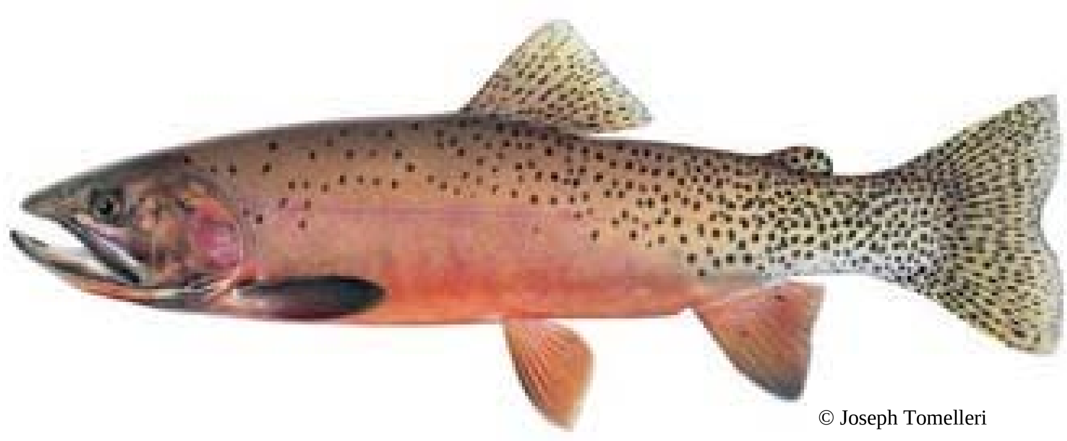
Environmental Assessment of
Removal of Nonnative Brook Trout and Introduction of Native Westslope Cutthroat Trout in Hyde Creek
Two Medicine Drainage

Draft Environmental Assessment



November 14, 2013

Montana Fish, Wildlife & Parks

Region 3 and 4 Offices

Montana Fish, Wildlife & Parks

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List of Abbreviations

BMP	Best management practice
DEGEE	Diethyl glycol monoethyl ether
DEQ	Montana Department of Environmental Quality
EA	Environmental Assessment
EIS	Environmental impact statement
EPA	US Environmental Protection Agency
FWP	Montana Fish, Wildlife & Parks
GNF	Gallatin National Forest
$KMnO_4$	Potassium permanganate
MCA	Montana Code Annotated
MCTSC	Montana Cutthroat Trout Steering Committee
MEPA	Montana Environmental Policy Act
MNHP	Montana Natural Heritage Program
MOU	Memorandum of understanding
MSDS	Material safety data sheet
NEPA	National Environmental Policy Act
PEG	Polyethylene glycol
USFWS	U.S. Fish and Wildlife Service

Executive Summary

Hyde Creek originates along the Rocky Mountain Front and flows north until its confluence with South Fork Two Medicine River. Hyde Creek is within the Lewis and Clark National Forest and accessible by trails. Historically, the Two Medicine River watershed supported westslope cutthroat trout (*Oncorhynchus clarkii lewisi* - WCT) throughout 857 miles of stream. Non-hybridized westslope cutthroat trout now reside in 23 miles within the larger watershed and are absent in Hyde Creek and its tributaries. Nonnative brook trout are present in Hyde Creek and nonnative rainbow trout and brook trout are common in the adjacent South Fork Two Medicine River. As a steep waterfall blocks fish passage near the mouth of Hyde Creek, Hyde Creek may have been historically fishless. Alternatively, westslope cutthroat trout may have gained access to Hyde Creek over geologic time, as westslope cutthroat trout are often present above barriers. Indeed, barrier falls or other features blocking fish are a primary reason any non-hybridized and slightly hybridized westslope cutthroat trout remain in the Missouri River drainage. The scenario of local extinction of non-hybridized westslope cutthroat trout and replacement by hybrids or nonnatives is common in the upper Missouri River basin, with core or conservation[1] populations occupying less than 8% of their historic habitat (Shepard et al. 2005).

The reduced abundance and distribution of westslope cutthroat trout within its historic range, especially east of the Continental Divide, has spurred considerable concern over the persistence of the subspecies, and has resulted in lawsuits to include westslope cutthroat trout for protection under the Endangered Species Act. Although the U.S. Fish and Wildlife Service (USFWS) has decided listing was unwarranted, fisheries managers, conservation groups, tribes, and various industry concerns joined to form the Montana Cutthroat Trout Steering Committee (MCTSC) to guide restoration of westslope cutthroat trout and Yellowstone cutthroat trout within their historic ranges. This collaboration has resulted in development of a memorandum of understanding (MOU) designed to ensure the long-term, self-sustaining persistence of westslope cutthroat trout (MCTSC 2007). This project is consistent with the third objective of the MOU, which calls for reestablishing non-hybridized populations of westslope cutthroat trout populations where they have been extirpated. The action is also consistent with Montana Fish, Wildlife & Parks' (FWPs') *Statewide Fisheries Management Plan* (FWP 2013), which specifies restoring non-hybridized westslope cutthroat trout to at least 20% of its historic range.

This document is an environmental assessment (EA) of the potential consequences of the two components of the preferred alternative, which entails removal of nonnative fishes, followed by reintroduction of native westslope cutthroat trout. EAs are a requirement of the Montana Environmental Policy Act (MEPA), which requires state agencies to consider the environmental, social, cultural, and economic effects of proposed actions. This EA considers 3 alternatives:

[1] Core populations have less than 1% of genes of rainbow trout or Yellowstone cutthroat trout origin. Conservation populations possess less than 10% of genes.

1. No action.
2. Removal of fish using rotenone, followed by reintroduction of non-hybridized westslope cutthroat trout transferred from a nearby, wild source. Piscicide treatment would be limited to waters within the project area (Figure 2) followed by a detoxification zone created by the release of potassium permanganate ($KMnO_4$).
3. Removal of brook trout using mechanical means, such as electrofishing, angling, or both, followed by reintroduction of non-hybridized westslope cutthroat trout.

Alternative 2 is the preferred alternative. Evaluation of the potential effects of this approach indicates it would have minor, short-term effects on water quality lasting no more 2 to 3 days. During the treatment, $KMnO_4$ would detoxify rotenone beginning at the barrier falls, which will limit the spatial extent of rotenone toxicity. Rotenone is toxic to gilled organisms at exceedingly low concentrations, resulting in a temporary reduction of gilled aquatic invertebrates, although many species are resilient to this level of rotenone. The concentration of rotenone needed to kill fish is far below levels that would be harmful to other organisms exposed to rotenone, through dermal exposure, drinking treated water, or scavenging dead fish and invertebrates. Mitigation would relate to actions that minimize the concentration of rotenone in treated waters, limiting the spatial extent of rotenone treatment, and ensuring protection of the health of applicators. Conducting a bioassay would allow determination of the lowest effective concentration of rotenone necessary to achieve project goals. Moreover, detoxification stations would limit the extent of rotenone treated area. Applicators would wear protective gear as described in to prevent dermal or inhalation exposure. The proposed action also involves re-introduction/introduction of native westslope cutthroat trout obtained from a nearest neighbor population. We propose a transfer of non-hybridized WCT from Midvale Creek (Glacier National Park and Blackfeet Nation lands). Midvale Creek is currently a mixed population of hybridized fish (WCT x Rainbow Trout) and non-hybridized fish. We propose genetically testing Midvale Creek WCT, holding them and then moving them after purity is confirmed through laboratory analysis. Non-hybridized WCT would be transferred via helicopter. If Midvale Creek WCT were to develop into a hybrid swarm with no pure individuals prior to the time of transfer – an alternative suitable population would be used.

MEPA also requires public involvement and opportunity for the public to comment on projects undertaken by state agencies. A 30-day public comment period will extend from November 15th, 2013 to December 14, 2013. If public interest is sufficient, FWP will hold a public meeting. Interested parties should send comments to:

Montana Fish, Wildlife & Parks
c/o Hyde Creek EA comments
(406) 791-7775
Great Falls, MT 59405
4600 Giant Springs Road

Or FWPHydeComments@mt.gov

1.0 PROPOSED ACTION DESCRIPTION

1.1 Type of Proposed Action

The action is a native fish conservation project entailing removal of nonnative species and reintroduction of native westslope cutthroat trout.

1.2 Agency Authority for Proposed Action

Authority to conduct the proposed actions comes from the Montana Administrative Code (87-1-702). Specifically, this statute authorizes Montana Fish, Wildlife & Parks (FWP) "to perform such acts as may be necessary to the establishment and conduct of fish restoration and management projects".

FWP powers and duties: The department shall implement programs that:

(i) manage wildlife, fish, game, and nongame animals in a manner that prevents the need for listing under 87-5-107 or under the federal Endangered Species Act, 16 U.S.C. 1531, et seq.;

(ii) manage listed species, sensitive species, or a species that is a potential candidate for listing under 87-5-107 or under the federal Endangered Species Act, 16 U.S.C. 1531, et seq., in a manner that assists in the maintenance or recovery of those species. Section 87-1-201(9)(a) M.C.A.

1.3 Estimated Commencement Date and Schedule

This action would commence in late summer or early fall of 2013. Piscicide treatment would take 2 to 3 days to complete. Additional treatments may follow in the next year if a total fish removal is not achieved.

1.4 Name and Location of Project

The name of this project is *Removal of Nonnative Fishes with Rotenone and Restoration of Westslope Cutthroat Trout in Hyde Creek*. Hyde Creek flows through the Lewis and Clark National Forest and is accessible by trail (Figure 2). The project area would include Hyde Creek and the fish-bearing portions of its tributaries. A relatively short detoxification zone would begin just below the barrier falls and would extend up to ½-miles down South Fork Two Medicine River.

1.5 Project Size (Acres Affected)

		Acres/miles			Acres/miles
(a)	Developed	0	(d)	Floodplain	0
	Residential	0			
	Industrial	0	(e)	Productive	0
				Irrigated cropland	0
(b)	Open space/woodlands/recreation	0		Dry cropland	0
				Forestry	0
				Rangeland	0
(c)	Wetlands/riparian areas	6 miles		Other	0
			(f)	Stream miles	6

1.6 Name and Address of Project Sponsor

Montana Fish, Wildlife & Parks
c/o Hyde Creek EA comments
4600 Giant Springs Road
(406) 791-7775
Great Falls, MT 59405

1.7 Project Maps

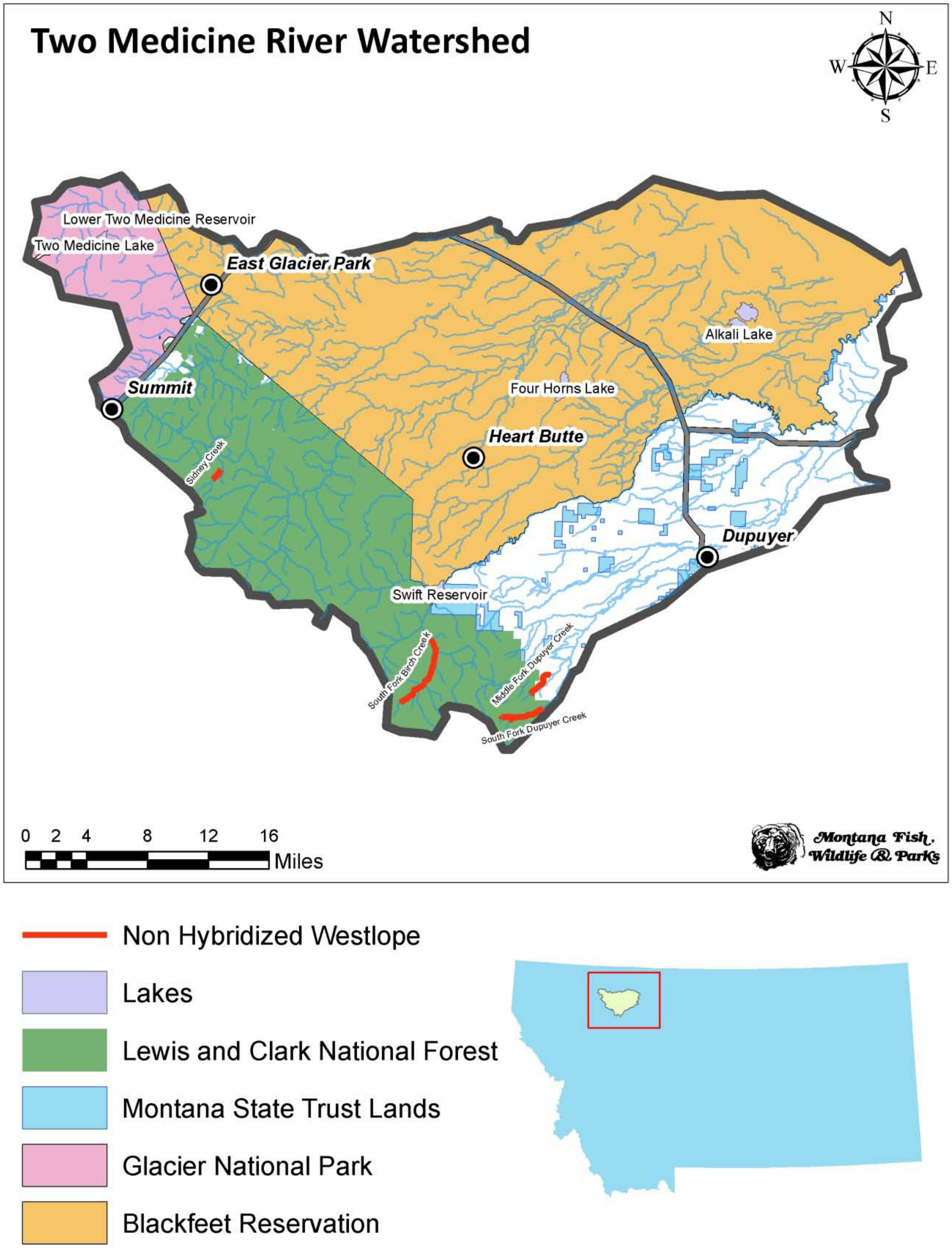

Figure 1: Overview of the Two Medicine River watershed showing distribution of non-hybridized, slightly hybridized, and historic distribution of westslope cutthroat trout.

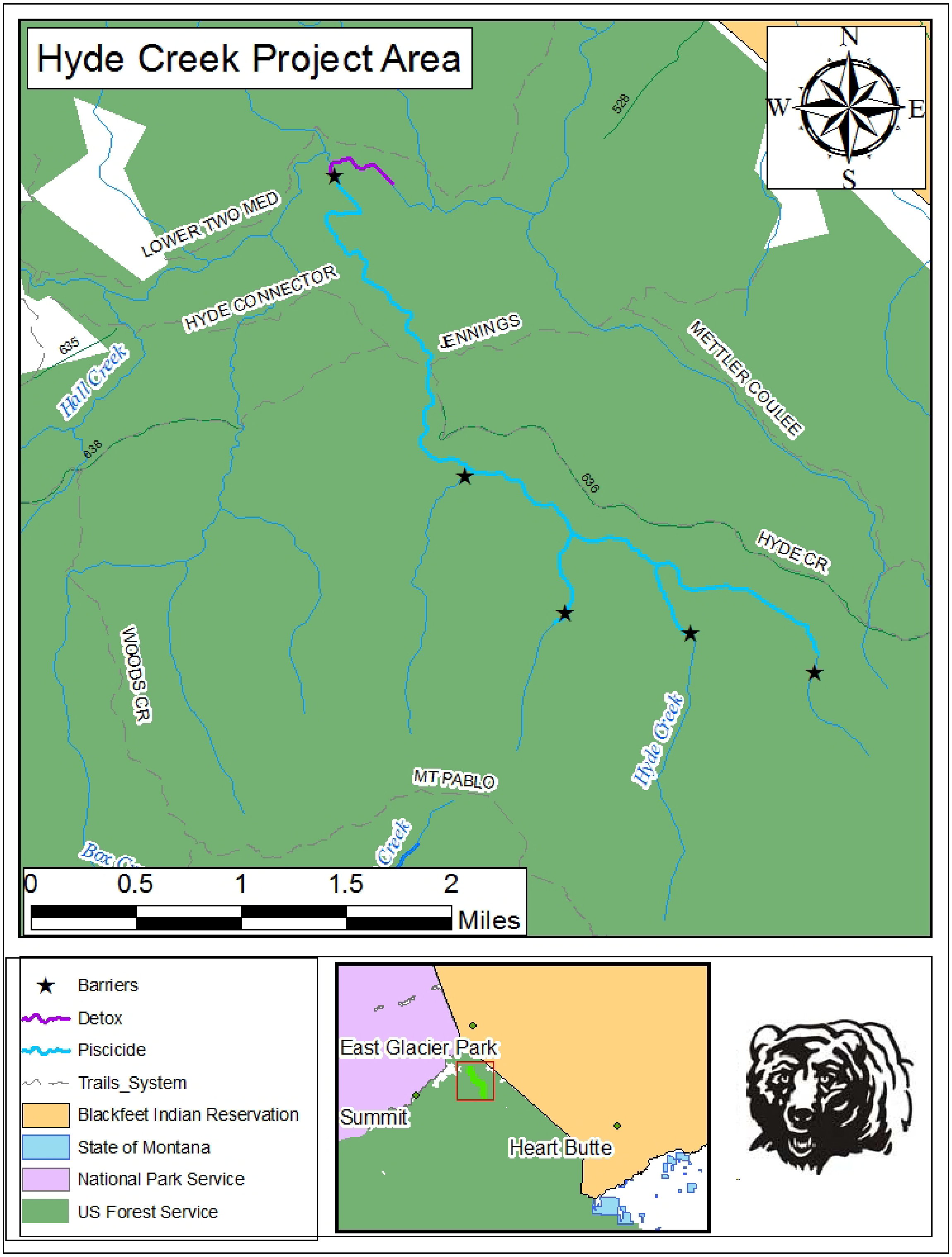

Figure 2: Hyde Creek westslope cutthroat trout restoration project area.

1.8 Narrative Summary of the Proposed Action and Purpose of the Proposed Action

1.8.1 Status of Westslope Cutthroat Trout in the United States of America including Montana

The westslope cutthroat trout is one of two subspecies of cutthroat trout that are native to Montana. Similar to Yellowstone cutthroat trout, the other native cutthroat trout, westslope cutthroat trout have declined substantially in abundance and distribution within its historic range (Shepard et al. 2005). Before westward expansion and settlement, westslope cutthroat trout were widely distributed throughout the panhandle of Idaho and much of the western half of Montana (Figure 3). In addition, westslope cutthroat trout were native to several isolated watersheds in Washington and Oregon. Westslope cutthroat trout no longer occupy a considerable portion of its historic habitat and most of the remaining populations show some level of hybridization with nonnative species.

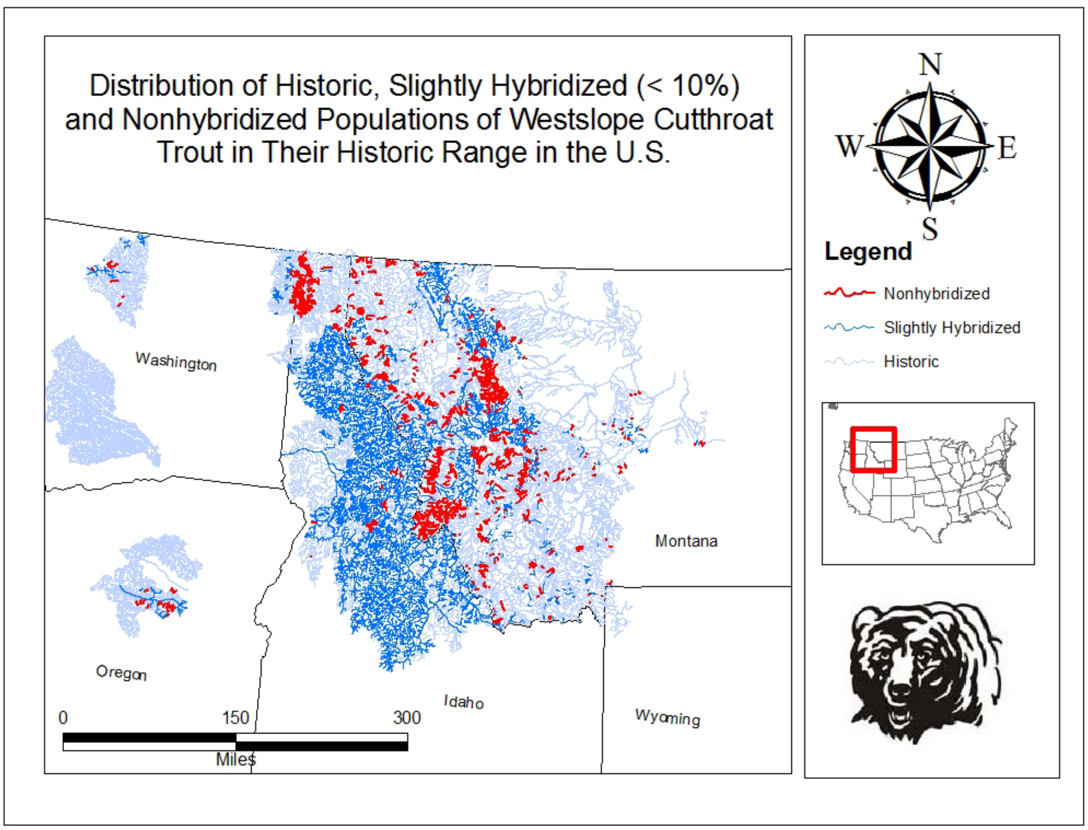

Figure 3: Distribution of historic, slightly hybridized, and non-hybridized populations of westslope cutthroat trout across its native range (State of Washington fisheries database 2009).

For conservation planning, Montana considers the Missouri River watershed, east of the Continental Divide, as a separate management area (Figure 4). Compared to the westslope cutthroat trout populations on the west side of the Continental Divide, non-hybridized populations in the Missouri River drainage are exceedingly rare and occupy less than 4% of their historical habitat (FWP 2009). More slightly hybridized populations exist than non-hybridized populations, but these are also rare, fragmented, and typically relegated to small reaches of headwater streams. Projects that preserve, restore, or protect non-hybridized populations of westslope cutthroat trout are necessary to prevent the extinction of the species and decreases justification for listing westslope cutthroat trout under the Endangered Species Act.

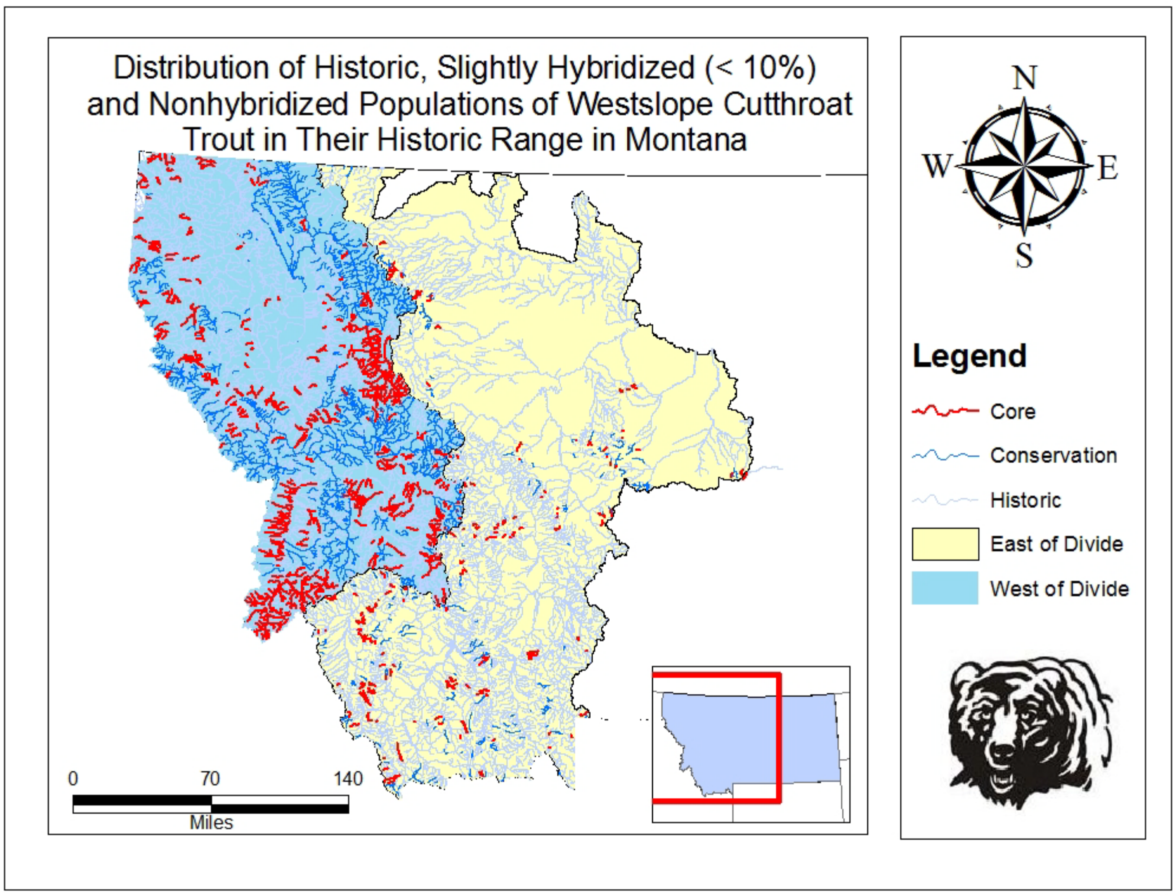

Figure 4: Distribution of historic, slightly hybridized (< 10%), and non-hybridized populations of westslope cutthroat trout in its historic range in Montana.

Although human-caused disturbances such as habitat degradation, dewatering, and barriers to fish movement have contributed to declines of westslope cutthroat trout, introduction of nonnative species has been the primary cause of reductions in distribution and abundance throughout their native range (Behnke 1992). Rainbow trout and Yellowstone cutthroat trout readily interbreed with westslope cutthroat trout resulting in formation of hybrid swarms (Allendorf and Leary 1988; Hitt et al. 2003). Brook trout are highly competitive with cutthroat trout, and can rapidly displace cutthroat trout, especially at higher elevations (Dunham et al. 2002; Peterson et al. 2004). Brown trout compete with westslope cutthroat trout and as brown trout consume fish, predation may be another mechanism reducing the range of westslope cutthroat trout. The remaining populations of westslope cutthroat trout east of the divide exist primarily because barriers to upstream migration, such as waterfalls, culverts, or dry reaches of channel, have prevented invasion of nonnative species.

Unfortunately, humans were the means by which nonnatives arrived in the Hyde Creek and throughout the West. In past decades, fisheries agencies stocked large numbers of nonnative species, or subspecies, into streams and lakes to compensate for overfishing, habitat degradation, pollution, or to augment recreational angling. This lack of foresight resulted in marked reductions in distribution and abundance of native cutthroat trout. Although FWP has no records of stocking brook trout in Hyde Creek, their presence upstream of a waterfall suggests humans were the means by which this nonnative species arrived there. This stocking could have been intentional, but not recorded, or recreationalists may have moved fish upstream of the barrier falls.

The role of species introductions in declines of inland native trout is substantial and well documented. At 10-year intervals, the American Fisheries Society publishes a list of imperiled freshwater and diadromous fishes[2] (Jelks et al. 2008). On this list are 35 freshwater fishes of the genus *Oncorhynchus*, which includes subspecies of cutthroat and distinct populations of rainbow trout, golden trout (*O. aquabonita*), and redband trout. Other members of the genus on the list include Mexican trout (*O. chrysogaster*), Apache trout (*O. gilae apache*), and Gila trout (*O. g. gilae*). Two of these unique fishes are extinct or probably extinct. Species introductions were among causes of decline of 100% of these species, subspecies, and distinct populations. In comparison, habitat degradation was not as common as species introductions as being a factor in reductions of native trout, being implicated for declines of 93% of the imperiled fish species. Although habitat degradation is a contributing factor in declines of native trout, introductions of nonnatives is the universally common type of threat to the persistence of inland trout species.

Other evidence implicating nonnatives as a primary cause of decline in our native trout and their relatives entails examining fish community composition in streams flowing through areas lacking appreciable human disturbance. The relatively pristine habitats in national parks and designated wilderness provide a natural laboratory for evaluating the relative roles of habitat degradation and nonnative species in declines of native cutthroat and their relatives. For

[2] Diadromous fish species live the adult portions of their lives in marine environments and return to their natal streams to spawn. Some diadromous fishes drift to the ocean soon after hatching. Others live one to several years in freshwater before swimming…..?

example, in the portions of the Bob Marshall Wilderness east of the Continental Divide, non-hybridized and slightly hybridized westslope cutthroat trout populations occupy about 15 stream miles, and a barrier protects every one of these populations. In contrast, rainbow trout occupy over 150 miles of stream within the east side of the wilderness area and brook trout occur in over 170 miles. Yellowstone National Park and Glacier National Park are experiencing the same threats, including hybridization with rainbow trout, and expansion and ultimate displacement of/predation on cutthroat trout by brook trout and lake trout, despite minimal human disturbance to streams and lakes (Yellowstone National Park 2010; Downs et al. 2011; Downs et al. 2013). These findings underscore the threat posed by nonnative species, even in undisturbed habitat, and the need to remove their populations in select streams and lakes to ensure the protection and persistence of our native trout.

Marked reductions in distribution and abundance of westslope cutthroat trout in their historic range has resulted in their designation as a species of special concern (MNHP and FWP 2012) and has resulted in litigation for inclusion of westslope cutthroat trout for protection under the Endangered Species Act. In response to these declines, designated status, and potential future lawsuits, a diverse group of state and federal agencies, agricultural and timber industry interests, and environmental advocacy groups (Table 1) developed a memorandum of understanding (MOU) to guide conservation, protection, and restoration of cutthroat trout in Montana (MCTSC 2007). This MOU places reestablishment of non-hybridized cutthroat trout in waters where they have been lost as its third most important objective. The other conservation objectives are to protect and secure the remaining populations, especially those lacking hybridization, and continued survey to locate new populations

Table 1: Participants and signatories on cutthroat trout conservation MOU (MCTSC 2007).

Category	*Entity*	*MCTSC Participants*	*Agreement Signatories*
Conservation and Resource Users	American Wildlands	✓	✓
	Federation of Fly Fishers	✓	✓
	Greater Yellowstone Coalition	✓	✓
	Montana Chapter of the American Fisheries Society (MCAFS)	✓	✓
	Montana Trout Unlimited	✓	✓
	Montana Wildlife Federation	✓	✓
Industry	Montana Farm Bureau	✓	✓
	Montana Stockgrowers Association	✓	✓
	Plum Creek Timber Company	✓	✓
Resource Agencies (federal)	Bureau of Land Management (BLM)	✓	✓
	Glacier National Park	✓	✓
	Natural Resources and Conservation Service (NRCS)	✓	✓
	U.S. Fish and Wildlife Service (USFWS)		✓
	U.S. Forest Service (USFS)	✓	✓
	Yellowstone National Park (YNP)	✓	✓

Resource Agencies (state)	Department of Environmental Quality (DEQ)		✓
	Department of Natural Resources and Conservation (DNRC)	✓	✓
	Montana Fish, Wildlife & Parks (FWP)	✓	✓
Tribes	Blackfeet Tribe	✓	✓
	Confederated Salish and Kootenai Tribes	✓	✓
	Crow Tribe	✓	✓

In addition to the commitment towards conservation of westslope cutthroat trout among stakeholders involved in the MOU, conservation of westslope cutthroat trout is a priority for FWP. FWP recently released its *Statewide Fisheries Management Plan* (FWP 2013) and this proposed project is consistent with the goals and objectives of this plan. In particular, the plan specifies a goal of restoring westslope cutthroat trout to 20% of its historically occupied habitat in the Missouri River watershed, with populations spread out geographically across the historic range. The broad distribution is a cautious approach that prevents catastrophic events, such as floods, fire, drought, or disease, from affecting all populations. Populations unaffected by severe disturbance can serve as donor populations to repopulate extirpated populations.

1.8.2 Proposed Action

The proposed action is a native species conservation project involving probable reestablishment of westslope cutthroat trout in Hyde Creek, a tributary of the South Fork Two Medicine River. FWP would remove the existing fishery and reintroduce native westslope cutthroat trout using wild fish obtained from a nearby population. Removal of the existing fish in Hyde Creek would entail the use of rotenone. FWP has a long history of using rotenone to manage fish populations in Montana, spanning as far back as 1948. The department has administered rotenone projects for a variety of reasons, but rotenone is principally applied to improve angling quality or for native fish conservation.

A distinct advantage of reestablishing westslope cutthroat trout in Hyde Creek is the presence of a barrier falls near its confluence with the South Fork Two Medicine River. This impassable falls eliminates the need to construct a barrier to prevent reinvasion of nonnative fishes. In many other cases, barrier construction is a necessary component of the fish conservation action. The cost of barrier construction varies and depends on the type of barrier that would be effective at a specific location. In some cases, installation of an impassible culvert or blasting rock to form a waterfall is possible and relatively inexpensive. These options can cost as little as $20,000. In many other cases, construction of a concrete barrier is necessary. Funds required for concrete barriers depend of the size of the barrier and remoteness of the site. Costs of barriers constructed in Montana have ranged as high as $410,000, although $150,000 is a more typical amount. Sites with an existing barrier provide an attractive option for cutthroat trout restoration projects, as they do not entail the costs of barrier construction, which can often be substantial.

Figure 5. Barrier falls near the mouth of Hyde Creek.

Rotenone would be the piscicide used to reclaim Hyde Creek for westslope cutthroat trout. Rotenone is a naturally occurring substance derived from the roots of tropical plants in the pea family (Fabaceae), such as the jewel vine (*Derris* spp.) and lacepod (*Lonchocarpus* spp.), which are found in Australia and its surrounding Pacific islands, southern Asia, and South America. Native people have used locally available rotenone for centuries to capture fish for food. Fisheries managers in North America have used rotenone since the 1930s. Rotenone is also a natural insecticide, and was once used in organic gardening and to control parasites such as lice on domestic livestock (Ling 2002).

Rotenone acts by inhibiting oxygen transfer at the cellular level. Fish are especially vulnerable to low levels of rotenone, as they readily absorb rotenone into the bloodstream through the thin cell layers of the gills. Mammals, birds, reptiles, and other non-gill breathing organisms lack this rapid absorption route into the bloodstream, and can tolerate exposure to concentrations that are much higher than levels that are lethal to fish.

CFT Legumine™ (Prentiss 2007a) is the brand of rotenone selected to treat flowing waters in the project area. The concentration of CFT Legumine applied would follow the manufacturer recommendations for "normal pond use", which amounts of 0.5 to 1 part per million[3] (ppm). Once diluted in the drip stations and the stream, the effective concentration of rotenone would be 0.025 parts per billion (ppb) to 0.05 ppb. To put the effective concentration of rotenone into perspective, these concentrations are roughly equal to 1/400 to 1/800 of a grain of table salt per liter. This concentration does not pose a threat to any organisms likely to be present in the project area, except for fish and some gilled invertebrates. Timing of application would protect amphibians, and aquatic invertebrates would be resilient to this concentration and recolonize through natural mechanisms.

A second type of rotenone may be applied on a limited basis. "Dough balls" consist of a mixture of Prentox™ (Prentiss 2007b), which contains 7% rotenone, sand, and gelatin. These "dough balls" are effective in preventing fish from finding refugia in springs, seeps, and at the mouths of small, fishless tributaries.

The rotenone-treated area on Hyde Creek would include all fish bearing waters upstream of the barrier site, which is approximately 6 miles of stream. Several tributaries are either ephemeral, or lack sufficient flow or habitat to support fish; however, installation of drip stations or placement of rotenone treated "dough balls" near the confluence of these streams would eliminate the potential for fish to seek refugia near their mouths.

Drip stations containing diluted rotenone would be placed at regular intervals from 1 to 2 hours of water travel time. Regularly spaced drip stations are necessary because of rapid natural breakdown, dilution, and detoxification of rotenone in stream environments. Each drip station dispenses a precise amount of dilute rotenone over 4 to 8 hours. The required concentration of CFT Legumine in drip stations depends on existing stream flow, measured in cubic feet per second, and the results of on-site bioassays. Areas of standing water that could hold fish would be treated with the use of backpack sprayers. These sprayers would deliver the same concentration of diluted rotenone as drip stations.

[3] The concentration ppm (parts per million) is equivalent to mg/L

Figure 6. Example of a drip station used to deliver CFT Legumine.

Rotenone detoxifies through three potential mechanisms: natural oxidation, dilution by freshwater, and introduction of a strong oxidizing/neutralizing agent, such as $KMnO_4$. Factors influencing natural oxidation include water temperature, water chemistry, and exposure to organic substances, air, and sunlight (Engstrom-Heg 1972; Gilderhus et al. 1986; Loeb and Engstrom-Heg 1970; ODFW 2002; Ware 2002). Dilution occurs through upwellings of groundwater and flow contributed from tributaries.

This project will ensure detoxification through application of $KMnO_4$ immediately downstream of the barrier falls, which would limit the spatial extent of the treatment area. Full neutralization of rotenone requires a short mixing zone, which would extend approximately ¼ to ½ miles downstream from the $KMnO_4$ application site. Application rates of $KMnO_4$ would be based on stream flow and natural background levels of oxidation. A handheld colorimeter would measure levels of $KMnO_4$ to guide application rates. Detoxification of dough balls would occur through natural oxidation, dilution, and binding with organic material.

Caged fish would allow evaluation of the toxicity and detoxification downstream of and within the project area. These sentinel fish (brook trout) would be placed above drip stations to ensure toxic concentrations of rotenone are maintained between stations. During treatment, sentinel fish placed downstream of the project area, and replaced regularly, would indicate when the water is no longer toxic. The CFT Legumine label specifies that once caged fish show no signs of distress for 4 hours, the stream water is no longer toxic, and detoxification can cease.

The goal is to eradicate fish with the first treatment. Nonetheless, occasionally some fish escape lethal exposure. FWP would ascertain effectiveness of the treatment using electrofishing. In the event the treatment did not result in a complete fish kill, additional treatments may be implemented to fulfill the project's objectives.

Once fish are eradicated from the project area, FWP would return non-hybridized westslope cutthroat trout to this small portion of its native range. Several options for restocking westslope cutthroat trout are available. Planting live fish (juveniles and adults) is among the alternatives. The use of on-site incubators containing fertilized or eyed eggs is another potential approach. Regardless of the mode of reintroduction, the fish placed in Hyde Creek would come from a non-hybridized population of westslope cutthroat trout from a nearby source. Before transfer of westslope cutthroat trout to Hyde Creek, FWP would conduct a careful analysis of the potential source populations to ensure the population is non-hybridized and disease-free. Midvale Creek (Glacier National Park and Blackfeet Nation) is an historical population of WCT protected by an infrastructure dam that once provided water to the town of East Glacier. The dam was recently breached, resulting in passage of rainbow trout and hybrid trout from downstream areas. Currently, Midvale Creek supports a mixed population of hybrid trout and non-hybridized fish throughout its length. Without action, this pure population will be effectively extirpated through hybridization. Rescue of fish from Midvale Creek would require genetic testing of individual fish prior to transfer to Hyde Creek. Transfers would likely occur over several years with the minimum number of fish transferred to achieve the goal of a healthy genetically diverse population of WCT in Hyde Creek

1.9 Agencies Consulted During Preparation of the Draft EA

Agency consultation included communications with project partners, permitting agencies, and entities with information relevant to potential consequences of this project. These included the Lewis and Clark National forest (LCNF), Glacier National Park (GNP), Blackfeet Nation, Montana Department of Environmental Quality, and the Montana Natural Heritage Program (MNHP).

2.0 ENVIRONMENTAL REVIEW

2.1 Physical Environment

2.1.1 Land Resources

1. Land Resources	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Soil instability or changes in geologic substructure?		X				

b. Disruption, displacement, erosion, compaction, moisture loss, or over-covering of soil, which would reduce productivity or fertility?		X				
c. Destruction, covering, or modification of any unique geologic or physical features?		X				
d. Changes in siltation, deposition, or erosion patterns that may modify the channel of a river or stream, or the bed or shore of a lake?		X				
e. Exposure of people or property to earthquakes, landslides, ground failure, or other natural hazard?		X				

2.1.2 Water

2. Water	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Discharge into surface water or any alteration of surface water quality, including but not limited to temperature, dissolved oxygen, or turbidity?			X		Yes	2a
b. Changes in drainage patterns or the rate and amount of surface runoff?		X				
c. Alteration of the course or magnitude of flood water or other flows		X				
d. Changes in the amount of surface water in any body of water, or creation of a new body of water?		X				
e. Exposure of people or property to water-related hazards such as flooding?		X				
f. Changes in the quality of groundwater?		X				2f
g. changes in the quantity of groundwater?		X				
h. Increase in risk of contamination of surface water or groundwater?			X		Yes	2c
i. Effects on any existing water right or reservation?		X				
j. Effects on other water users as a result of any alteration in surface or		X				2j

groundwater quality?						
k. Effects on other users as a result of any alteration in surface or groundwater quantity?		X				
l. Would the project affect a designated floodplain?		X				
m. Would the project result in any discharge that would affect federal or state water quality regulations?			X		Yes	2m

Comment 2a: Alterations in Water Quality

Alterations in water quality would result from the piscicide and $KMnO_4$ application components of this project. This project would involve discharge of rotenone into Hyde Creek. Rotenone is an insecticide formerly used in organic agriculture and home gardening, as well as being an effective piscicide. Rotenone comes from the roots and stems from a variety of tropical and subtropical plants in the pea family (Fabaceae). The molecular constituents of rotenone are carbon, hydrogen, and oxygen and detoxification entails breaking rotenone into these nontoxic components. Rotenone is relatively inexpensive and accessible, and is a routine method to remove unwanted fish from lakes and streams. Rotenone acts by blocking the ability of tissues to use oxygen, which causes fish to asphyxiate quickly.

Rotenone is a highly reactive molecule, a factor favoring its quick decomposition in the environment. This degradability is in marked contrast to some synthetic pesticides. Organochlorines are pesticides comprised of chlorinated hydrocarbons, and include chemicals such as DDT, heptachlor, and chlordane. These compounds persist in the environment long after their release, making the behavior and fate of organochlorine pesticides substantially different from rotenone, which breaks down within days, or less, in a stream or soil environment.

Organophosphates are another class of pesticide that differs markedly from rotenone in terms of threats to human health and the environment. Commonly used organophosphate pesticides include malathion, parathion, and diazinon. Although these chemicals are considerably less persistent than the organochlorines, they are more acutely toxic, and act as potent neurotoxins. Organophosphate poisonings are one of the most common causes of poisoning worldwide. In contrast, rotenone does not share this acute toxicity to humans with the organophosphate pesticides.

CFT Legumine (Prentiss 2007a) is the rotenone formulation proposed for this project. The EPA has registered this formula (Reg. No. 75338-2), and approved its use as a piscicide. Information on its chemical composition, persistence in the environment, risks to human health, and ecological risks come from a number of sources including material data safety sheets (MSDS) and manufacturer’s instructions. (A MSDS is a form detailing chemical and physical properties of a compound, along with information on safety, exposure limits, protective gear required for safe handling, and procedures to handle spills safely.) In addition, Fisher (2007) analyzed the concentrations of major and trace constituents in CFT Legumine, evaluated the toxicity of each, and examined persistence in the environment.

The MSDS for CFT Legumine lists three categories of ingredients for this formula (Table 2). Rotenone comprises 5% of CFT Legumine by weight. Associated resins account for 5%, and the remaining 90% are inert ingredients, of which the solvent n-methylpyrrolidone is a component. Additional information in the MSDS confirms rotenone's extreme toxicity to fish.

Table 2: Composition of CFT Legumine from material safety data sheets (MSDS)

Chemical Ingredients	*Percentage by Weight*	*CAS. No.[1]*	*TLV[2] (units)*
Rotenone	5.00	83-79-4	5 mg/m^3
Other associated resins	5.00		
Inert ingredients including n-methylpyrrolidone	90	872-50-4	Not listed

[1]Chemical abstracts number
[2]A TLV reflects the level of exposure that the typical worker can experience without an unreasonable risk of disease or injury (see 2.2.3 . Risks/Health Hazards)

Analysis of the chemical composition of CFT Legumine found that on average, rotenone comprised 5% of the formula (Fisher 2007), consistent with MSDS reporting. Other constituents were solvents or emulsifiers added to assist in the dispersion of the relatively insoluble rotenone. DEGEE, or diethyl glycol monoethyl ether, a water-soluble solvent, was the largest fraction of the CFT Legumine analyzed. Likewise, n-methylpyrrolidone comprised about 10% of the CFT Legumine™. The emulsifier Fennedefo 99™ is an inert additive consisting of fatty acids and resin acids (by-products of wood pulp and common constituents of soap formulations), and polyethylene glycols (PEGs), which are common additives in consumer products such as soft drinks, toothpaste, eye drops, and suntan lotions. Trace constituents included exceptionally low concentrations of several forms of benzene, xylene, and naphthalene. These organic compounds were at considerably lower concentrations than measured in Prenfish, another commercially available formulation of rotenone, which uses hydrocarbons to disperse the piscicide. Their presence in trace amounts in CFT Legumine relates to their use as solvents in extracting rotenone from the original plant material.

Table 3: Average percent concentrations and ranges of major constituents in CFT Legumine (Fisher 2007).

Major CFT LegumineFormula Constituent	*Rotenone*	*Rotenolone*	*n-methylpyrrolidone*	*DEGEE[1]*	*Fennedefo 99*
Average %	5.12	0.718	9.8	61.1	17.1
Range	4.64-5.89	0.43-0.98	8.14-10.8	58.2-63.8	15.8-18.1

[1]diethyl glycol monoethyl ether

Persistence in the environment and toxicity to nontarget organisms are major considerations in determining the potential risks to human health and the environment, and several factors influence rotenone's persistence and toxicity. Rotenone has a half-life of 14 hours at 24 °C, and 84 hours at 0 °C (Gilderhus et al. 1986, 1988), meaning that half of the rotenone is degraded and is no longer toxic in that time. As temperature and sunlight increase, so does degradation of rotenone. Higher alkalinity (>170 mg/L) and pH (>9.0) also increase the rate of degradation. Rotenone tends to bind to, and react with, organic molecules rendering it ineffective, so higher concentrations are required in streams with increased amounts of organic matter. Without detoxification, rotenone would degrade to nontoxic levels in one to several days due to its break down and dilution in the aquatic environment.

Proposed mitigative activities would further reduce the spatial and temporal extent of rotenone toxicity. A detoxification station established immediately below the barrier falls would release $KMnO_4$ to the effective concentration of 0.5 to 1 ppm. This strong oxidizer rapidly breaks down rotenone into its nontoxic constituents of carbon, oxygen, and hydrogen, with total breakdown occurring within 15 to 30 minutes of exposure, which is typically ¼ to ½-miles stream travel time. $KMnO_4$ in turn breaks down into potassium, manganese, and water, which are common constituents in surface waters, and have no deleterious effects at the concentrations used (Finlayson et al. 2000). In addition, $KMnO_4$ is a commonly used oxidizer in wastewater treatment plants, so its release into streams and rivers is a regular and widespread phenomenon. The result of release of $KMnO_4$ on water quality would be elimination of toxic concentrations of rotenone. Additional back up detoxification station would be on-site and deployed if necessary.

The concentration of rotenone in treated waters is another factor relating to potential effects from incidental ingestion by other organisms, including humans. The effective concentration of rotenone is 0.025 to 0.05 ppb, which is roughly equivalent to 1/400 to 1/800 of a grain of table salt per liter. In contrast, concentrations at 14 ppm (9,800 grains of salt per liter) pose no adverse effects to human health from chronic ingestion of water (National Academy of Sciences 1983). Moreover, concentrations associated with acute toxicity to humans are 300-500 mg per kilogram of body weight (Gleason et al. 1969), which means a 160-pound person would have to drink over 23,000 gallons in one sitting to receive a lethal dose (Finlayson et al. 2000). Similarly, risks to wildlife from ingesting treated water are exceptionally low. For example, ¼-pound bird would have to consume 100 quarts of treated water, or more than 40 pounds of fish and invertebrates, within 24 hours for a lethal dose (Finlayson et al. 2000). The EPA, in their recent reregistration evaluation of rotenone (EPA 2007), concluded that exposure to rotenone, when applied according to label instructions, presented no unacceptable risks to humans and wildlife. In summary, this project would have no adverse effect on humans or wildlife associated with ingesting water, dead fish, or dead invertebrates.

Bioaccumulation of rotenone would not result in threats to human health and the environment under the preferred alternative. Rotenone can bioaccumulate in the fat tissues of fish that are not exposed to toxic levels (Gingerich and Rach 1985). As a complete fish-kill is the goal, and application will occur over a short time period, bioaccumulation would not be a problem. Moreover, breakdown of rotenone in killed fish and invertebrates would also be rapid, so scavengers, such as skunks, mink, or birds would not experience chronic exposure.

Potential toxicity and persistence of the other constituents of the CFT Legumine formulation are additional considerations. Proposed concentrations of n-methylpyrrolidone (about 2 ppm) would have no adverse effects to humans ingesting treated waters. According to the MSDS, ingestion of 1000 ppm per day for three months does not result in deleterious effects to humans. In addition, n-methylpyrrolidone would not persist in surface waters given its high biodegradability. This rapid degradation, combined with its low toxicity, makes n-methylpyrrolidone a commonly used solvent in wastewater treatment plants.

Fisher (2007) examined the toxicity and potential persistence of other major constituents in CFT Legumine, including DEGEE, fatty acids, PEGs, and trace organic compounds, (benzene, xylene, naphthalene). With proposed application of CFT Legumine, none of these compounds would violate water quality standards, nor would they reach concentrations shown to be harmful to wildlife or humans. Furthermore, persistence of these chemicals was not a concern. The trace organics would degrade rapidly through photolytic (sunlight) and biological mechanisms. Likewise, the PEGs would biodegrade in a number of days. The fatty acids would also biodegrade, although they would persist longer than the PEGs or benzenes. Nonetheless, these are not toxic compounds, so the relatively longer persistence would not adversely affect water quality. The trace organics would be at exceptionally low concentrations given dilution of the formula added to the drip station, followed by dilution in the stream. These organic compounds would be well below laboratory detection limits and levels that are harmful. Moreover, these are moderately to highly volatile chemicals that would break down through the same mechanisms as rotenone, namely oxidation, dilution, and treatment with $KMnO_4$. Overall, the low toxicity, low persistence, and lack of bioaccumulation indicate the inert constituents in CFT Legumine would have a minor and temporary effect on water quality.

To reduce the potential risks associated with the use of CFT Legumine, the following management practices, mitigation measures, and monitoring efforts would be employed:

1. A pretreatment bioassay would be conducted to determine the lowest effective concentration and travel time of the chemical in the stream.
2. Signs would be posted at trailheads and along the stream to warn people not to drink the water, consume dead fish, or have recreational contact with the water.
3. Piscicides would be diluted in water and dripped into the stream at a constant rate using a device that maintains a constant head pressure.

4. A detoxification station would be set up downstream of the target reach. $KMnO_4$ would be used to neutralize the piscicide at this point.
5. An additional detoxification site would be established downstream from the initial detoxification station as a safeguard.
6. Project personnel would be trained in the use of these chemicals including the actions necessary to deal with spills as prescribed in the MSDS for CFT Legumine.
7. Persons handling the piscicide would wear protective gear as prescribed in the CFT Legumine label.
8. Only the amount of piscicide and potassium permanganate that is needed for immediate use would be held near the stream.
9. Sentinel or caged fish would be located below the detoxification station and within the target reach to determine and monitor the effectiveness of both the rotenone and potassium permanganate.

The presence and fate of dead fish would be another potential alteration of water quality associated with piscicide treatment. Experience has shown that these fish sink in streams and are difficult to find within a few days. Leaving their carcasses to decompose within the stream would keep their nutrients within the stream. This increase in nutrients would temporarily increase biomass of algae, macroinvertebrates, and fish and jumpstart recovery of the stream ecosystem.

Comment 2f: Effects on Groundwater

Investigations on the fate and transport of rotenone in soil and groundwater indicate this project would not alter groundwater quality. Rotenone binds readily to soils and is broken down by soil and in water (Engstrom-Heg 1971; Dawson et al. 1991; 1976; Skaar 2001; Ware 2002). Because of its strong tendency to bind with soils, its mobility in most soil types is only one inch; although, in sandy soils, rotenone can travel up to three inches (Hisata 2002). Combined, the low mobility and rapid break down prevents rotenone from contaminating groundwater.

Groundwater investigations associated with several piscicide projects also indicate application of rotenone, and the inert ingredients, would not threaten groundwater quality. California investigators monitored groundwater in wells adjacent to, and downstream of rotenone projects, and did not detect rotenone, rotenolone, or any of the other organic compounds in the formulated products (CDFG 1994). Likewise, case studies in Montana have concluded that rotenone movement through groundwater does not occur. For example, FWP monitored a domestic well two weeks and four weeks after applying 90 ppb of rotenone to Lake Tetrault (FWP, unpublished data). This well was down gradient from the lake, and drew water from the same aquifer that drained and fed the lake; however, no rotenone or associated constituents were detectable. FWP monitored groundwater associated with several other rotenone projects, with wells ranging from 65 to 200 feet from the treated waters. Repeated sampling occurred within periods of up to 21 days, with no detectable concentrations of rotenone or the inert ingredients found.

One domestic well lies relatively close to the lower end of the treatment area (GWIC database 2012). This well within the LCNF and is above 1000 feet away from Hyde Creek. Given the minute distance rotenone travels through soils (1 to 3 inches), its low mobility in groundwater, and its rapid breakdown, this project would not result in contamination of the neighboring well.

Comment 2j: Effects on Other Water Users

Rotenone treatment has potential to affect irrigation uses and contact recreationists. CFT Legumine's label prohibits irrigation of crops with treated water, and prohibits "release within ½ mile upstream of a potable water or irrigation diversion". The label prohibits swimming in rotenone-treated water "until the application has been completed, and all pesticide has been thoroughly mixed into the water according to labeling instructions."

Distance from irrigated agriculture and potable water sources, and detoxification would prevent effects on agricultural uses and human health. Detoxification would degrade rotenone to nontoxic levels within 15 to 30 minutes of travel time from the barrier. In addition, irrigated agriculture does not begin until several miles downstream, which exceeds the ½-mile requirement. The nearest private land and potential potable surface water withdrawal is well over ½ miles from the detoxification site.

Recreationists currently use water from Hyde Creek for their own consumption, following filtering, and for pets and horses. Posted warnings throughout the project area would alert recreationalists of the treatment underway and continue for a few days afterward as an additional precautionary measure. Preventing exposure of livestock to treated waters would entail moving cattle off the riparian area or to an area outside the project area.

Comment 2m: Discharge Affecting Water Quality Regulations

This project would involve discharge of CFT Legumine, an EPA registered piscicide, to Hyde Creek and select tributaries. Montana state law (MCA 75-5-308) allows application of registered pesticides to control nuisance aquatic organisms, or to eliminate undesirable and nonnative aquatic species. FWP would apply rotenone under DEQ's General Permit for Pesticide Application (#MTG87000). DEQ accepted a notice of intent in a letter dated August 13, 2012 that allows FWP to operate under the General Permit for Pesticide Application. These requirements call for minimizing the concentration and duration of chemical to the extent practicable. FWP would accomplish this by performing a bioassay to determine the lowest, effective concentration of rotenone. Comment 2a and 8c, address risks to the environment and public health, which would be short-term and minor, or negligible.

Cumulative Effects on Water

The piscicide treatment would result in short-term toxicity to fish and other gilled organisms for up to 3 days, including bioassay. Detoxification at the downstream end of the project area would limit the spatial extent of toxic water (Figure 2). Even without detoxification, the rotenone would dilute or break down in a matter of days, making the effects on water quality short-term and minor. The other constituents of CFT Legumine are not toxic at concentrations applied and would break down rapidly through hydrolysis, bacteria, and oxidation (Fisher 2007), as would the $KMnO_4$ when applied according to the manufacturer's label. Constituents with longer persistence are nontoxic and do not pose a threat to the environment.

2.1.3 Air

3. Air	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Emission of air pollutants or deterioration of ambient air quality?			X		yes	3a
b. Creation of objectionable odors?		X				3b
c. Alteration of air movement, moisture, or temperature patterns, or any change in climate, either locally, or regionally?		X				
d. Adverse effects on vegetation, including crops, due to increased emissions of pollutants?		X				

Comments 3a: Emission of Air Pollutants or Deterioration of Ambient Air Quality
Short-term and minor alterations of air quality would likely occur because of this project. A gasoline generator would run a power auger at the downstream end of the treatment area to dispense powdered $KMnO_4$. These fumes would dissipate rapidly in the outdoors. In addition, helicopter support to transfer westslope cutthroat trout to Hyde Creek would result in emission of exhaust. Similar to the generator, this exhaust would dissipate rapidly.

Comments 3b: Creation of Objectionable Odors
The potential for objectionable odors comes from the use of chemicals to treat the stream, exhaust from the generator and helicopter, and the presence of dead fish. The responses to Comments 3a address the fumes from the generator and helicopter. These would be short-term and minor.

The piscicide formulations proposed for this project would have no short-term and minor effects with respect to the creation of objectionable odors. Unlike other formulations of rotenone, CFT Legumine uses soaps and nontoxic solvents to disperse the relatively insoluble rotenone. Compared to the formulations that used aromatic petroleum solvents such as toluene, benzene, xylene, and naphthalene, CFT Legumine does not have an objectionable odor and does not bring inhalation risks at concentrations applied in the stream. Prenfish, the formulation that may be used in dough balls does contain organic solvents. Nonetheless, the fumes from these highly volatile substances would dissipate quickly in the outdoor environment.

Previous experience has not shown an appreciable increase in objectionable odors from dead fish. Most dead fish sink and any odor from their decomposition does not enter the air column. Fish stranded in shallow water or at the channel margins may result in creation of objectionable odors as they decompose; however, scavengers and rapid decay would make this consequence short-term and minor.

Cumulative Effects on Air

The cumulative effects on air quality would be short-term and minor. Exhaust from generators and helicopters transporting fish would dissipate quickly. The CFT Legumine formulation does not have an objectionable odor given the nontoxic solvents and dispersants used in this product. Fumes from the aromatic solvents used in Prenfish would dissipate rapidly given their high volatility. Moreover, use of Prenfish dough balls would be limited to small areas within the project area, so the spatial extent would be extremely limited. Odors from decaying fish would be minor and short-term. Most fish sink and are not exposed to the air. Decomposition and scavenging of fish stranded in shallow water or stream margins would make the potential creation of unpleasant odors short-term and minor.

2.1.4 Vegetation

4. Vegetation	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Changes in the diversity, productivity, or abundance of plant species (including trees, shrubs, grass, crops, and aquatic plants)?			X		Yes	4a
b. Alteration of a plant community?		X				
c. Adverse effects on any unique, rare, threatened, or endangered species?		X				4c
d. Reduction in acreage or productivity of any agricultural land?		X				
e. Establishment or spread of noxious weeds?			X		X	4e
f. Would the project affect wetlands, or prime and unique farmland?		X				

Comment 4a: Changes in the Diversity, Productivity, or Abundance of Plants

During treatment, workers would access drip stations from existing USFS trails. Fieldworkers would trample vegetation along the stream during the placement and monitoring of drip stations and sentinel fish locations; however, the degree of damage to vegetation would not affect plant vigor and trampled plants would recover quickly. Horses would transport gear and supplies and would trample and consume vegetation. These disturbances would also be short-term and minor. Moreover, these trails experience considerable use by horsemen and women, so disturbance by horses is a regular occurrence. The project would be unlikely to increase use of Hyde Creek by anglers, so an increase in fishing pressure over the long-term is unlikely. Rotenone does not have an effect on plants, which accounts for its use as a pesticide in organic agriculture.

Comment 4c: Effects on Unique, Rare, Threatened or Endangered Species

The MNHP database lists 5 plant species of concern within the township and range in which Hyde Creek flows (Table 4). Field guide information on their life history characteristics and habitat allow inference on the potential for the project to affect these plants. The MNHP also includes rationale for inclusion of a plant species on the list of species of special concern, which provides additional information to determine the potential of the proposed project to influence the species (Table 5). The primary disturbance to sensitive plants with this project would be trampling along the stream margins.

Table 4: Unique, rare, threatened, or endangered plant species in the township and range within the project area (T30N R13W).

Group	*Scientific Name*	*Common Name*	*Global Rank*	*State Rank*	*USFS Rank*
Moonworts	Botrychium sp.	Moonworts	G1[1]G3	S1[1]S3[3]	
Plantain	Gratiola ebracteata	Bractless hedge-hyssop	G4[4]	S2[2]	
Buttercups	Ranunculus orthorhynchus	Straightbeak buttercup	G5[5]	S1S2	
Pondweeds	Potamogeton obtusifolius	Blunt-leaved pondweed	G5	S3	Sensitive[6]
Lichen	Melanelia commixta	Camouflage lichen	GNR[7]	S1	

[1]G1 or S1: At very high risk of extinction or extirpation in the state due to **extremely limited** and/or **rapidly declining** population numbers, range and/or habitat. or extirpation in the state.
[2]G2 or S2: at high risk of extinction or extirpation in the state due to very limited and/or declining numbers, range, and/or habitat, or extirpation in the state
[3] G3 or S At risk of extinction or extirpation in the state due to limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas.
[4] G4 or S4: Apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining
[5] G5 or S5: Common, widespread and abundant, although it may be rare in parts of its range. Not vulnerable in most of its range
[6] Sensitive: Listed as a sensitive species by the USFS Northern Region
[7]GNR: not ranked as of yet.

Table 5: Rationale for inclusion of plant species on MNHP's list of species of special concern.

Common Name	*Rationale for Inclusion*

Moonworts	This is a general record for Botrychium species tracked by MTNHP MTNHP tracks and maintains observation data for all Botrychium species in the state excluding B. multifidum and B.virginianum which are fairly common and readily identifiable from all other Botrychiums Global and state ranks for this record are placeholders only to allow Botrychium SOC to appear in searches using global and state ranks For information pertinent to specific Botrychium species, please see the individual species' accounts in the Field Guide.
Bractless Hedge-hyssop	Rare and peripheral in Montana Currently known from approximately a half-dozen wetlands along the Rocky Mountain Front and from a couple historical collections Available data for the species are limited However, threats to existing populations appear to be minimal As an annual, population levels likely fluctuate widely from year to year.
Straightbeak Buttercup	Rare in Montana, where is is known from the western portion of the state based upon several specimen collections However, only one collection has been made in the past two decades Additional data are need to determine this species' status.
Blunt-leaved Pondweed	Known from over a dozen occurrences in northwest Montana Several contain moderate to large-size populations and occur in valley and foothill locations in a variety of federal, state, and private ownerships A few populations are on lands managed specifically for their conservation value Some populations are vulnerable to impacts associated with development, recreation and increased sediment and nutrient loads.
Camouflage Lichen	Known from very few locations in northwest Montana.

The MNHP lists 15 species of moonwort on its list of species of special concern, but is nonspecific on which species have been found near Hyde Creek. The rationale for including moonworts on the list of species of special concern for the Hyde Creek area is that one or more rare species have been documented within the township and range. The MNHP considers this listing a general record for members of the genus *Botrychium* as the program tracks and maintains observation data for many species of this genus. Most of the moonwort observations come from west of the Continental Divide. Among the moonworts listed as species of special concern, six have potential to be near the Hyde Creek project area. Examination of the field guide information indicates the streamside habitat is not suitable habitat or that the plant will be past its sensitive reproductive stage during the project. Similarly, the habitat is not suitable for the bractless hedge-hyssop.

The straightbeak buttercup has potential to be within the project area and stream banks are among preferred habitats; however, piscicide application will occur following the reproductive stage, so trampling will not damage flowering plants. Moreover, this species is rare in Montana, with only 4 observations documented. Therefore, the probability of encountering this plant is low. Nonetheless, fieldworkers will be provided with field guide information on this buttercup to avoid inadvertent trampling. The combination of project timing and rarity of this flower means that adverse effects are improbable and any disturbance would be short-term and minor.

The blunt-leaved pondweed is also a plant with negligible potential to be affected by this project. Its habitat is not montane streams, but shallow water of lakes, ponds, and sloughs. Should this type of standing water exist within the project area, application of rotenone would not affect this rare plant, as rotenone is not toxic to plants. If present in treated waters, plants may temporarily increase in biomass as herbivory from aquatic invertebrates populations may be reduced temporarily by rotenone treatment. Finally, even if within the project area, the project area is past the fruiting phase of this plant, so the next season's seed crop would be unaffected.

The final species of special concern is the camouflaged lichen. The MNHP's field guide provides little information on this lichen, other than to describe its rarity. Likewise, an Internet search yielded little information other than what the MNHP field guide provided. As a result, information on typical habitat, life history stages, and appearance is lacking. As lichens occupy a wide range of habitats from forest canopy, rocks, and ground surfaces, predicting where this lichen would occur is difficult with the available information. If the camouflaged lichen is a ground-dwelling species, it has evolved with some level of trampling, so several days of streamside occupancy of fieldworkers would be a short-term and minor disturbance. Moreover, its rarity suggests the likelihood of encountering the lichen in the field is low. Therefore, overall effects of this project on this species would be at most, short-term and minor.

Comment 4e: Establishment or Spread of Noxious Weeds
The potential for spread of noxious weeds is relatively low, as Hyde Creek is accessible only by hiking trails. Therefore, the typical mode of weed dispersal, seeds in the undercarriage of vehicles, does not exist for this project. Seeds attached to the footwear or clothing of fieldworkers is a potential source of weed seeds. Fieldworkers would bring only clean, weed-free clothing and footwear into the project area. Note that cleaning waders of debris to prevent spread of whirling disease is standard practice and would decrease the potential for carrying weeds into the site. Horses used in transporting gear would be fed weed free hay.

Cumulative Effects on Vegetation
Both components of the project, fish eradication and reintroduction would have minor, short-term effects on vegetation. Trampling of vegetation by field crews and horses is the primary disturbance: however, this would be short-term and minor as plants are resilient to this level of use. A separate project is possible for the nearby Box Creek. This project would not occur during the same year, so trampling and forage consumption would not be cumulative, as plants would have time to recover between projects. The lack of motorized vehicles and ensuring fieldworkers bring weed free footwear and clothing would result in little potential for spread of noxious weeds.

Although several species of special concern are within the general area of the project, any disturbance to these would be short-term and minor. Factors contributing to a low potential for adverse effects on rare plants include project timing, overall rarity of most species, and the lack of appropriate habitat within the project area for most species.

2.1.5 Fish and Wildlife

5. Fish and Wildlife	Impact	Can	Comment

Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**	**Impact be Mitigated?**	**Index**
a. Deterioration of critical fish or wildlife habitat?		X				
b. Changes in the diversity or abundance of game animals or bird species?			X		Yes	5b
c. Changes in the diversity or abundance of nongame species?			X		Yes	5c
d. Introduction of a new species into an area?		X				5d
e. Creation of a barrier to the migration or movement of animals?			X		Yes	5e
f. Adverse effects on any unique, rare, threatened, or endangered species?		X				5f
g. Increase in conditions that stress wildlife populations or limit abundance (including harassment, legal or illegal harvest, or other human activity)?			X			See also 5b and 5c
h. Would the project be performed in any area in which T&E species are present, and would the project affect any T&E species or their habitat?			X			5f
i. Would the project introduce or export any species not presently or historically occurring in the receiving location?		X				See 5d

Comment 5b: Changes in the Diversity or Abundance of Game Animals or Bird Species

The goal of this project is potential introduction or restoration of a population of native westslope cutthroat trout. Doing so effectively requires the use of rotenone, which would eliminate nonnative brook trout. The current barrier falls is a barrier to upstream fish movement, Thus, Hyde Creek may have been originally fishless. Hyde Creek is within the native range of WCT and barriers typically protect the remaining westslope cutthroat trout populations east of the Continental Divide. These factors add credence to the possibility that westslope cutthroat trout may have accessed Hyde Creek over geologic time. Although the historic status of westslope cutthroat trout in Hyde Creek is unknown, this project is consistent with the MOU for conserving cutthroat trout in Montana (MCTSC 2007). Restoring westslope cutthroat trout to previously occupied waters is the MOU's highest priority. Establishing populations upstream of barriers where they did not exist historically, but within their historic range, is the third highest conservation objective.

Replacing brook trout with westslope cutthroat trout may result in changes in abundance and biomass of fish. Nonnative brook trout can have higher densities and biomass than populations of native cutthroat trout; however, earlier age classes appear to account for the majority of the increased production (Benjamin and Baxter 2010). The westslope cutthroat trout population should reach its equilibrium within 5 to 7 years. Although the biomass and abundance may be less than with brook trout, a greater proportion of the population would be catchable fish.

Impacts to Midvale Creek, the proposed source population would be minor. Only the minimum number of non-hybridized fish needed to form a genetically healthy and diverse population would be transferred. Additionally, Midvale Creek currently supports hybridized WCT along its entire length. Given time, Midvale will undoubtedly form a hybrid swarm wherein every fish is of hybrid origin. Given the risks of no action in Midvale Creek, we feel that the proposed action is the best course of action to preserve the genetic legacy of one of the few remaining non-hybridized populations in the Two-Medicine drainage.

Game species such as mule deer (*Odocoileus hemionus*), moose (*Alces alces*), black bears (*Ursus americanus*), and mountain lions (*Felis concolor*) and several species of mountain grouse are likely present within the project area. Presence of field crews could temporarily displace these species for the 4 to 5 day duration of the project. This would be a short-term disturbance and game species would return after completion of the piscicide project and reintroduction efforts.

Comment 5c: Changes in the Diversity or Abundance of Nongame Species

This piscicide portion would have potential to result in changes in diversity and abundance of a variety of nongame wildlife species. Range maps, observation data, and field guide information housed by the MNHP[4] allowed determination of species likely to occur within the project area. In addition, the MNHP is a source of information on the habitats, food preferences, and life history strategies, which provided for an informed evaluation of potential effects. This section examines the risks to wildlife associated with direct exposure to rotenone, a diminished prey base relating to reduced biomass of fish or aquatic invertebrates, or exposure to rotenone through ingestion of dead animals or treated water. For mobile species, the presence of humans, horses, and a helicopter would result in temporary displacement, which would be short-term and minor.

Brook trout and westslope cutthroat trout may be functionally different predators, which may result in changes in species composition of the aquatic invertebrate community (Benjamin et al. 2011; Lepori et al. 2012). This difference in may also change trophic or food web level functioning. Nonetheless, overall density and production of invertebrates has not been detectable in macroinvertebrate communities facing brook trout versus cutthroat trout predation (Lepori 2012). Restoring the native fish species is consistent with improved biological integrity, as the

[4] http://mtnhp.org/

native fish would exert the same community level pressure on invertebrates with which they evolved.

Rotenone is highly toxic to fish, and treatment would have immediate effects on fish within the treatment area. Comment 5b addresses effects on game fish, which would be minor and temporary, as restocking would restore a population of non-hybridized westslope cutthroat trout. The presence of a barrier falls suggests sculpin (*Cottus* spp.) were historically absent from Hyde Creek as this small, bottom-dwelling taxon does not disperse over waterfalls. Sculpin present downstream of the waterfalls, within the detoxification zone, may experience toxic levels of rotenone. This would be a minor and short-term effect on this species, which would recolonize this ¼ to 1/2- mile reach from neighboring, untreated reaches.

Gilled aquatic invertebrates are nontarget organisms with considerable potential to experience negative effects from piscicide treatment. In streams, benthic populations of true flies, stoneflies, mayflies, and caddis flies would be the primary affected taxa. Owing to a number of factors, these effects would be short-term and temporary. Investigations into the effects of rotenone on benthic organisms indicate that rotenone results in temporary reduction of stream-dwelling invertebrates. In one case, no significant reduction in aquatic invertebrates occurred despite concentrations of rotenone being twice as high as the proposed concentration (Houf and Campbell 1977). In other cases, invertebrates recovered quickly following treatment. For example, following piscicide treatment of a California stream, macroinvertebrates experienced an “explosive resurgence” in numbers, with black fly larvae recovering first, followed by mayflies and caddis flies within six weeks after treatment (Cook and Moore 1969). Stoneflies returned to pretreatment abundances by the following spring. Another mitigative factor is that invertebrates that were most sensitive to rotenone also tended to have the highest rate of recolonization due to short life cycles (Engstrom-Heg et al. 1978). Although gill-respiring invertebrates are a sensitive group, many are far less sensitive to rotenone than fish (Schnick 1974; Chandler and Marking 1982; Finlayson et al. 2010). Due to their short life cycles (Anderson and Wallace 1984), good dispersal ability (Pennack 1989), and generally high reproductive potential (Anderson and Wallace 1984), aquatic invertebrates are capable of rapid recovery from disturbance (Boulton et al. 1992; Matthaei et al. 1996).

Larval drift and reproduction by aerial adults are the primary mechanisms of recovery, and several miles of stream upstream of the treatment area would provide a source of drifting invertebrates to treated waters. Likewise, aerial adults would lay eggs and repopulate invertebrate communities. The relative small amount of stream treated and proximity to source populations would further expedite this recovery. Moreover, treatment would occur following emergence of most invertebrates, so that much of the invertebrate community would be in a less vulnerable life history stage.

The well-established ability of macroinvertebrates to recover following disturbance, combined with the lower susceptibility of many taxa to rotenone, would contribute to rapid recovery of invertebrate populations. Disturbance is a common occurrence in streams and includes floods, wildfire, and human-caused alterations such as incompatible livestock grazing practices (Mihuc and Minshall 1995; Wohl and Carline 1996; Minshall 2003). These disturbances have greater potential to have long-term effects on stream-dwelling assemblages than piscicide treatments given changes in geomorphology, impairment of riparian health and function, and reduced water quality.

The MNHP's list of species of special concern does not report any rare or unique invertebrates within the general area of the Hyde Creek project, nor has monitoring in neighboring streams found any species of special concern. Numerous instances of pre-project sampling in fish bearing or fishless waters have never detected invertebrate species of special concern (D. Gustafson, Montana State University, personal communication). Non-fish bearing reaches within the watershed would not be treated, so invertebrates that have not coevolved with fish would not be affected.

Amphibians are closely associated with water, and have potential to be exposed to rotenone during treatment. Species that may be in the treatment area are the Columbian spotted frog (*Rana luteiventris*), Rocky Mountain tailed frog (*Ascaphus montanus*), boreal chorus frog (*Pseudacris maculata*) and the western toad (*Bufo boreas*). Of these, the Columbian spotted frog and Rocky Mountain tailed frog have the greatest probability for exposure to rotenone, given their preference for streamside or in-stream habitat. Western toads are less dependent on surface water, except for during the breeding season, so these species have a lower probability of encountering rotenone treated waters. Boreal chorus frogs occupy standing water only during the spring breeding season then move to their terrestrial habitat for the rest of the year.

Applying rotenone to Hyde Creek would likely have negligible, if any, effect on most species of juvenile amphibians given the physical setting and proposed timing of piscicide application. Similar to other gill-bearing organisms, amphibian larvae are sensitive to rotenone, and exposure to rotenone at levels used to kill fish is acutely toxic to Columbian spotted frog larvae and Rocky Mountain tailed frog larvae (Grisak et al. 2007). Although tadpoles may be vulnerable to rotenone, at least some species may be up to 10 times more tolerant than fish (Chandler and Marking 1982). Nonetheless, the potential for exposure for tadpoles of most species would be minimal in Hyde Creek, as this relatively high gradient mountain stream simply does not provide suitable slow water or lentic rearing habitat. Moreover, treating the stream in early fall past the larval stage would prevent exposure in the event unidentified beaver ponds or other backwater features were present. Treatment in late summer or early fall is a recommended BMP to prevent effects on most amphibians, as they would be past the gilled life history stage (Grisak et al. 2007).

Rocky mountain tailed frogs may be present in Hyde Creek and this species would be the most vulnerable to piscicide (Bryce Maxell, MNHP, personal communication). One reason is they have an extended gilled stage lasting 3 years. In addition, they are an obligate aquatic species and would be unlikely to leave a stream during treatment. Finally, the vulnerability of Rocky Mountain tailed frogs to rotenone has been tested only on gilled tadpoles, so the susceptibility of later life history stages is unknown.

Given these factors, the following recommended mitigative actions will diminish the population level effect of rotenone treatment on Rocky Mountain tailed frogs (B. Maxell, MNHP, personal communication). Before piscicide treatment, collection of these frogs using electrofishing or dip nets at four 100-yard reaches spaced evenly along Hyde Creek, and within one reach in each tributary, will provide a source for reintroduction. When present, these frogs are typically abundant and this level of effort would provide sufficient numbers for reestablishment of a population should the adults be vulnerable. The frogs would be held in live cars upstream of barrier falls in tributaries until the treatment is over and Hyde Creek is no longer toxic. Because Rocky Mountain tailed frogs tend to not disperse and show fidelity to specific habitat, the frogs would be returned to the areas from which they were caught. Follow up monitoring to evaluate the effectiveness of piscicide on fish would also evaluation the effect on Rocky Mountain tailed frogs. These mitigative actions will make the effects of piscicide treatment on Rocky Mountain tailed frogs short term and minor.

Effects on other adult amphibians would be insignificant given their low vulnerability to rotenone, mobility, and project timing. Adult Columbian spotted frogs do not suffer an acute response to trout killing concentrations of Prenfish, another commonly used formulation of rotenone that includes organic compounds (Grisak et al. 2007). Adult western toads would likely be less sensitive than frogs given their impermeable skin (Maxell and Hokit 1999). Moreover, adult toads and frogs have the ability to leave the aquatic environment, which substantially reduces the potential for exposure (Maxell and Hokit 1999). Boreal chorus frogs occupy terrestrial habitats, except for breeding in the spring. The combination of low vulnerability of these species to rotenone, their mobility, the habitat use of boreal chorus frogs means the effects on adult amphibians would be short term and minor.

Another consideration is the reproductive capacity of some of these species. Similar to invertebrates, Columbian spotted frogs show a prodigious ability to recolonize following piscicide treatment. Columbia spotted frogs rebounded the following spring after application of CFT Legumine in a lake at the concentration proposed for this project (Billman et al. 2012). As expected, gill-respiring tadpoles suffered total mortality in the 24 hours following exposure. In contrast, non-gill breathing metamorphs, juveniles, and adults did not show any apparent response. Follow up monitoring showed that tadpoles repopulated all treated waters and their numbers were similar to, or higher than, pretreatment levels.

Implementation of a basic monitoring plan would allow evaluation of the short and long-term effects of piscicide treatment on potentially sensitive taxa. The macroinvertebrate sampling component would involve sampling macroinvertebrates using standard operating procedures developed by DEQ. Sample collection will occur before piscicide treatment at two locations in Hyde Creek, and would be repeated two weeks after treatment, then for two years afterward. Fish recovery would be evaluated using electrofishing over the course of 5 years. A survey of birds, reptiles, amphibians, and mammals would take place before treatment, and would be repeated in each of the following two years.

A temporary reduction in prey of aquatic origin has potential to influence mammals, amphibians, reptiles, birds, and bats. The American mink is the mammalian predator of fish that is most likely to occur in the project area. Mink are opportunistic predators and scavengers, with fish and invertebrates comprising a portion of their diet. Therefore, the reduction in density of fish following treatment may displace mink to adjacent, untreated reaches until fish populations recover. Nonetheless, as opportunists, American mink have flexibility to switch to other prey species and the ability to disperse.

Other mammalian predators may experience short-term and minor consequences. Opportunistic black bears (*Ursus americanus*), raccoons (*Procyon lotor*), red foxes (*Vulpes vulpes*), coyotes (*Canis latrans*), and striped skunks (*Mephitis mephitis*) would likely consume dead fish immediately after piscicide treatment. The temporary reductions of aquatic prey, and the brief availability of dead fish, constitute short-term and minor effects on mammalian predators and scavengers.

A number of bird species with potential to occur within the project area consume fish or invertebrates with an aquatic life history stage. The belted kingfisher (*Megaceryle alcyon*) consumes fish as its primary food source. The American dipper (*Cinclus mexicanus*) forages for aquatic invertebrates in mountain streams year round. Numerous species of songbirds eat winged adults of invertebrates originating from streams. The effect of a reduction of forage base on these organisms would be minor and short-term. Belted kingfishers may be temporarily displaced from the project area, until westslope cutthroat trout rebound in Hyde Creek. As rotenone does not affect all aquatic invertebrates, some invertebrate prey would remain to support American dippers, although some level of displacement is possible. Note that follow up monitoring in Lower Deer Creek, one year post-treatment found American dippers at similar numbers as before treatment, presence of numerous juvenile birds, and location of a new dipper nest within the project area (C.L. Endicott, FWP, personal communication). Songbirds that consume invertebrates would still have access to insects of terrestrial origin. In addition, many songbird species would have migrated during the treatment period.

Two species of gartersnake, the common gartersnake (*Thamnophis sirtalis*) and the terrestrial gartersnake (*T. elegans*), likely occur along Hyde Creek, and a reduction in aquatic based food may affect these snakes, although these species are generalists and would still have forage from terrestrial sources. Similarly, the Columbian spotted frog regularly forages along stream margins. Effects on these reptile and amphibian predators would likely be short-term and minor, with temporary displacement or reductions in population size. On Lower Deer Creek, terrestrial gartersnakes consumed juvenile fish killed by rotenone. This boon was likely beneficial as it allowed building up of body reserves just before hibernation. Given the quick recovery expected of the fish and invertebrate prey base, gartersnakes would not experience long-term or significant adverse effects.

Bats also consume winged insects, and therefore, rotenone projects have potential to have a negative effect on bats. Diet preferences and seasonal habitat use for bats in the project area indicate effects on bats would be negligible. Bat species that may occur in the project area consume mostly invertebrates of terrestrial origin. Because of the rapid recovery of aquatic invertebrates, and a lack of reliance on invertebrates of aquatic origin, bats would experience no adverse effects from piscicide treatment in Hyde Creek.

Ingestion of rotenone, either from drinking water, or from consuming dead fish or invertebrates, is a potential route for rotenone exposure. A substantial body of research has investigated the effects of ingested rotenone in terms of acute and chronic toxicity, and other potential health effects. An important consideration in reviewing these studies is that most examined laboratory exposure to exceptionally high concentrations of rotenone that would be unattainable under proposed field application. The low level of effects at these super-elevated concentrations indicates risks to wildlife from exposure to proposed levels would be minor and short-lived, if wildlife experience any effects from ingesting treated water or dead fish and invertebrate.

In general, ingestion does not affect mammals because of digestive action in their stomach and intestines (AFS 2002). Investigations examining the potential for acute toxicity from ingesting rotenone find mammals would need to consume impossibly high amounts of rotenone-treated water or rotenone killed animals for a lethal dose. For example, a 22-pound dog would have to drink nearly 8,000 gallons of treated water within 24 hours, or eat 660,000 pound of rotenone-killed fish within a day to receive a lethal dose (CDFG 1994). A half-pound mammal would need to consume 12.5 mg of pure rotenone, or drink 66 gallons of water for a lethal dose (Bradbury 1986). In comparison, the effective concentration of rotenone to kill fish is 0.025 to 0.05 ppb, which is considerably lower than concentrations resulting in acute toxicity to mammals.

Evaluations of potential exposure of mammals relating to exposure from scavenging indicate acute toxicity from ingesting rotenone-killed fish is highly unlikely (EPA 2007). Estimation of the daily consumption of dead fish by an “intermediate-sized mammal” of 350 mg, which is about half the size of a male American mink, found an estimated daily dose of 20.3 µg of rotenone. This is well below the median lethal dose of 13,800 µg of rotenone for a mammal of that size. A “large mammal” is one with 1,000 g body weight, which is within the weight range for female American mink. If this size mammal fed exclusively on fish killed by rotenone, it would receive an equivalent daily dose of 37 µg of rotenone. In comparison, the estimated median lethal concentration of rotenone for a 1,000 g mammal was 30,400 µg, which is over 800 times the daily dose. The EPA (2007) concluded that piscivorous mammals were highly unlikely to consume enough fish to result in acute toxicity.

Chronic toxicity associated with availability of dead fish over time would not pose a threat to mammals, nor would other health effects be likely. Rats and dogs fed high levels of rotenone for six months to two years experienced only diarrhea, decreased appetite, and weight loss (Marking 1988). The unusually high treatment concentrations did not cause tumors or reproductive problems. Toxicology studies investigating potential secondary effects to rotenone exposure have found no evidence that it results in birth defects (HRI 1982), gene mutations (BRL 1982; Van Geothem et al. 1981), or cancer (Marking 1988). Rats fed diets laced with 10 to 1000 ppm of rotenone over a 10-day period did not experience any reproductive dysfunction (Spencer and Sing 1982). Furthermore, fish decay rapidly following piscicide treatment and the rotenone breaks down rapidly, so chronic exposure would not occur.

Concerns over putative links to Parkinson's disease often emerge in response to potential rotenone projects. This issue relates to a study in which rats injected with rotenone for up to 2 weeks showed lesions characteristic of Parkinson's disease (Betarbet et al. 2000). Review of the methodology employed in this study finds no similarities to fisheries related piscicide projects in terms of dose, duration of exposure, or mode of delivery. The rats received constant injection of rotenone and dimethyl sulfoxide directly into their bloodstream, resulting in continuously high concentrations of rotenone. The purpose of the dimethyl sulfoxide was to enhance tissue penetration of the rotenone, as normal routes of exposure actually slow introduction of chemicals into the bloodstream. In contrast, field exposure would involve far lower concentrations of rotenone, without the synergistic effects of dimethyl sulfoxide to promote uptake into tissues. Moreover, the rapid breakdown of rotenone in the environment would not support more than a few days of potential exposure from ingesting water or dead animals. Finally, continuous intravenous injection in no way resembles any potential mode of field exposure to rotenone, which would be ingestion of dilute rotenone in water, or consumption of fish or invertebrates killed by rotenone. As the injection study does not provide a model for potential effects of field application of rotenone, and other researchers have not found Parkinson's-like effects in exposed animals (Marking 1988), we conclude that rotenone application would not result in neurological risks to field exposed animals.

Birds may also scavenge dead fish and invertebrates, or ingest treated water; however, research on toxicity of rotenone to birds indicates acute toxicity was not possible from field application of rotenone to achieve a fish kill. In general, birds require concentrations of rotenone at least 1,000 to 10,000 times greater than is required for lethality in fish (Skaar 2001). Chickens, pheasants, and related gallinaceous birds are resistant to rotenone, and four-day-old chicks are more resistant than are adults (Cutkomp 1943). Rotenone is slightly toxic to waterfowl, although acute toxicity occurs at levels 2,000 times higher than the proposed treatment concentration (Ware 2002).

Evaluation of the risks to scavenging birds based on estimated daily dose and body size indicated no risk of acute toxicity from eating rotenone-killed fish (EPA 2007). The daily dose of rotenone from consumption of scavenged fish ranged from 15 µg to 95 µg. At this level of contamination, a raven-sized bird would need to consume from 43,000 to 274,000 dead fish in one day for a lethal dose.

Observations of terrestrial gartersnakes (*Thamnophis elegans*) consuming piscicide killed fish on Lower Deer Creek, near Big Timber, Montana indicates reptiles have potential to be exposed to rotenone by scavenging or drinking water. Although no studies on the effect of consumption on reptiles is available, snakes are likely highly invulnerable to a toxic effect. A snake's digestive system breaks down bone, fur, scales, and exoskeletons, and can likely handle the highly reactive and fragile rotenone molecule. Furthermore, the exposure concentrations are so low as to not affect other non-gill breathing organisms, suggesting snakes would have similar tolerance.

In summary, effects on nontarget species of wildlife would range from nonexistent to short-term and minor. Fish and benthic invertebrates would suffer total to some mortality; however, restocking and natural recovery would result in these effects being temporary. Some species may experience temporary reductions in prey base, which may displace these animals until fish and macroinvertebrate populations rebound. Concentrations of rotenone in water and dead fish would be thousands of times less than levels causing acute and chronic toxicity to animals ingesting treated water or dead fish. Moreover, as rotenone degrades rapidly, the duration of potential exposure would be short, measurable in days, which would not pose long-term threats to wildlife.

Comment 5d: Introduction of a New Species into an Area

The historic presence of westslope cutthroat trout in Hyde Creek is unknown. Westslope cutthroat trout are often present upstream of barriers such as waterfalls, despite a lack of evidence that stocking was the result of their presence. In fact, waterfalls and other barriers are the primary reason any westslope cutthroat trout populations remain east of the Continental Divide, indicating westslope cutthroat trout have been present upstream of barriers before the advent of species introductions. Humans most certainly placed brook trout in Hyde Creek.

As the historic status of westslope cutthroat trout in Hyde Creek is unknown, it is possible that FWP will be introducing a new species into the area. Therefore, this action would be consistent with the third highest objective of conservation planning for cutthroat trout in Montana (MCTSC). Alternatively, if westslope cutthroat trout were present, but displaced by nonnative brook trout, the project would be consistent with the highest conservation priority by restoring westslope cutthroat trout into historically occupied habitat. This action would be consistent with established conservation objectives and would result in an increase in the number of stream miles supporting westslope cutthroat trout.

Comment 5e: Creation of a Barrier to the Movement or Migration of Animals

This project will take advantage of an existing barrier falls to provide habitat for a pure population of westslope cutthroat trout. Some westslope cutthroat trout may move downstream over the falls; however, biologists working with this species have observed that non-hybridized westslope cutthroat trout rarely move downstream (D. Moser, FWP, personal communication).

Comment 5f: Effects on Unique, Rare, Threatened, or Endangered Animals

The MNHP database[5] lists 10 animal species of special concern as occurring in the township and range within the project area (Table 6). Field guide information provided by the MNHP website allows inference on potential effects of the project on these species. Evaluation of their habitat needs, forage base, and migration timing suggests effects on these species would be negligible or beneficial.

Table 6: Animal species of special concern known to occur in the township and range in which the Hyde Creek project lies (MNHP database).

Group	*Scientific Name*	*Common Name*	*Global Rank*	*State Rank*	*USFS*
Mammals	*Gulo gulo*	Wolverine	G4[4]	S3*3*	SENSITIVE
Mammals	*Lynx canadensis*	Canada lynx	G5[5]	S3	THREATENED[7]
Mammals	*Martes pennanti*	Fisher	G5	S3	SENSITIVE
Mammals	*Ursus arctos*	Grizzly bear	G4	S2S3	THREATENED
Birds	*Botaurus lentiginosus*	American bittern	G4	S3B	
Birds	*Histrionicus histrionicus*	Harlequin duck	G4	S2B	SENSITIVE
Birds	*Spizella breweri*	Brewer's sparrow	G5	S3B	
Amphibians	*Anaxyrus boreas*	Western toad	G4	S2[2]	SENSITIVE
Fish	*Oncorhynchus clarkii lewisi*	Westslope cutthroat trout	G4T3[8]	S2	SENSITIVE
Invertebrates	*Euphydryas gillettii*	Gillette's checkerspot	G3	S2	

[2]G2 or S2: at high risk of extinction or extirpation in the state due to very limited and/or declining numbers, range, and/or habitat, or extirpation in the state
[3] G3 or S At risk of extinction or extirpation in the state due to limited and/or declining numbers, range, and/or habitat, even though it may be abundant in some areas.
[4] G4 or S4: Apparently secure, though it may be quite rare in parts of its range, and/or suspected to be declining
[5] G5 or S5: Common, widespread and abundant, although it may be rare in parts of its range. Not vulnerable in most of its range
[6] Sensitive: Listed as a sensitive species by the USFS Northern Region
[7]Theatened: Listed as threatened under the Endangered Species Act
[8]T3: Rank of a subspecies

[5] http://mtnhp.org/default.asp

The primary disturbance to species of special concern would be associated with presence of humans, transport of gear and supplies by horses and hikers, and delivery of westslope cutthroat trout by helicopter. This increase in noise and human presence would be of short duration, lasting up to 5 days. This activity and presence would likely result in temporary displacement of most species if they were occupying the project area before the project began. If the project were not successful in the first year, a second round of piscicide application would occur the following year. None of the project activities would affect the habitat of these species or alter their food base. The presence of dead fish would increase scavenging by species prone to consuming carrion. As discussed in Comment 5c: Changes in the Diversity or Abundance of Nongame Species, exposure to rotenone from drinking water or eating dead fish or invertebrates does not pose a threat given the exceedingly low concentration of rotenone in water and dead animal tissues, and the rapid breakdown of the rotenone in the environment

Wolverines have a small potential to be within the project area. Observations of wolverines have occurred within the general area within the past 10 years (Montana Natural Heritage Field Guide). Their density in the area is likely to be low, with few observations reported. Wolverines occupy alpine areas, and coniferous or boreal forests. They typically have large home ranges and low densities – typically 1 per 25 square miles (Cegelski et al. 2003). Project activities, including piscicide application and fish reintroduction, would be short-term and minor effects on wolverines should they be present during the project. Given their tendency to be wide-ranging, temporary displacement, in the event they are occupying the project area, would result in them leaving a small portion of their home range. This disturbance would be of short duration, lasting no more than 5 days.

Canada lynx are on the endangered species list and listed as a threatened species. They occur in low densities near the project area; however, observations of Canada lynx in the project area are relatively old. This species is nonmigratory, but is wide ranging and movements of up to 125 miles have been recorded for Canada lynx in Montana (Hash 1990). Snowshoe hare are the preferred prey item of the Canada lynx; however, they will also consume mountain grouse, a variety of rodents, shrews, and occasionally will prey on ungulates and consume carrion.

The effect of this project on Canada lynx would likely be short-term and minor. Given their huge home ranges, the potential to encounter a lynx is small. The presence of humans, horses, and a helicopter would result in temporary displacement during the 4 to 5 days of the project. The piscicide treatment would not have an effect on most of their prey species, although as occasional consumers of carrion, they may feed on dead fish. As with other mammals, the dose of rotenone resulting from opportunistic feeding is thousands of times lower than toxic levels.

Fishers are a member of the weasel family with potential to be present within the project area. Estimated density of fishers within the project area is low and observations are relatively old, occurring 10 to 15 years ago. Fishers do not migrate, but make extensive movements throughout their home range. Fishers consume a variety of mammalian prey, birds, and fruit. They will eat carrion when available.

The effects of the project on fishers would likely be short-term and minor. The chance of encountering this species is small given their low densities and large home ranges. The presence of humans, horses, and a helicopter may displace fishers during the piscicide treatment and reintroduction of westslope cutthroat trout. This disturbance would be short-term and minor. Fishers may consume dead fish or drink treated waters; however, the concentration of rotenone in water and carcasses is well below toxic levels.

The grizzly bear is another listed species with considerable potential to occur in the project area. The MNHP field guide data indicate they are present at relatively high densities and sightings are relatively recent. Although project activities, such as the use of helicopters or pack stock, may temporarily displace bears, habituated bears may stay near the project area. Grizzly bears pose a much larger threat to fieldworkers than the project poses to grizzly bears. Fieldworkers would be carrying bear spray, so an encounter may result in a bear getting a dose of noxious pepper spray, which is the preferred and nonlethal way to protect humans and bears during any encounters.

To minimize the potential for conflict with grizzly bears, field crews would adhere to requirements outlined in the U.S. Department of Agriculture FS Food Storage Special Order LC-00-18. These requirements call for storing food for humans and livestock in a bear-resistant manner and packing out any leftover food and garbage. In addition, piscicide containers would be securely stored. Storing food properly, keeping a clean camp, and maintaining an audible presence while in the field would reduce the potential for bear encounters. Given these protective measures, effects on grizzly bears would be short-term and minor.

Of the birds within the MNHP's database likely to occur in the township and range through which Hyde Creek flows, only the harlequin duck has potential to be within the project area during piscicide treatment and fish reintroduction. Harlequin ducks spend most of the year along the west coast of North America. These ducks migrate to Montana from late April to early May. Drakes leave in June and the hens raise their broods in fast moving, low gradient, clear mountain streams. The hens and young leave Montana from late July through early September. MNHP reports few observations of harlequin ducks near the project area, although observations have been relatively recent, within the past 10 years.

Project activities have the potential to displace hens and young that have not yet migrated back to the west coast. With project timing slated for late August or early September, the young ducks should be able to fly as some birds leave as early as late July. This project could result in short-term displacement from Hyde Creek to neighboring waters, should they be present in the project area. Alternatively, the disturbance may be sufficient to spur migration.

American bitterns and Brewer's sparrows were among the species special of concern that occur in the section in which the project lies. The Hyde Creek project area does not provide suitable habitat for either species. American bitterns require marshy habitat with cattails and tall reeds. As a mountain stream, Hyde Creek does not provide this type of marshland. Brewer's sparrows are grassland birds and would not be present within the project area.

The westslope cutthroat trout is another species of special concern within the general area of the project, although core or conservation populations do not occur within the project area. This project would be beneficial to westslope cutthroat trout, as its goal is to reestablish a non-hybridized population within historically occupied habitat. This goal is consistent with the MOU for westslope cutthroat trout conservation (MCTSC 2007) and the *Statewide Fisheries Management Plan* (FWP 2013). It would also conserve locally adapted gene complexes that could be used in future reintroduction or restoration projects.

The Gillette's checkerspot is a species of butterfly with potential to occur within the project area. This species resides in a variety of damp habitats in mountains, including meadows, conifer forests, and streamsides. Gillette's checkerspots are rare throughout their range and occur in widely scattered, isolated colonies.

This project has low potential to have adverse effect on the Gillette's checkerspot butterfly. Caterpillars feed on a variety of shrub and flower species with young caterpillars living together in silk nests. Several of these plants have potential to be present in riparian areas, and fieldworkers may accidentally brush older caterpillars that are not encased in silk nests from vegetation when travelling along streams; however, this disturbance would be minor and short-term. Fieldworkers may flush adults from roosts, which is not a significant disturbance that would adversely affect the population.

The proposed transfer from Midvale Creek would have minimal impact on the current genetic health of WCT in Midvale Creek. Removal of a portion of non-hybridized WCT could potentially increase the level of hybridization in Midvale Creek at a very low level, likely less than 1%. The population in Midvale Creek is facing the specter of unchecked hybridization and will be genetically extirpated if no action is taken. The minimum number of WCT would be transferred – potentially over several years – to create a genetically robust population in Hyde Creek while minimizing demographic risks.

Comment 5g: Increase in Conditions That Would Stress Wildlife

See Comment 5b: Changes in the Diversity or Abundance of Game Animals or Bird Species, and Comment 5c: Changes in the Diversity or Abundance of Nongame Species.

Transfers from Midvale Creek or other suitable population might require the short-term use of a helicopter. Flight time in the source and donor drainages would be short term (1 to 2 hours). Flight times would be coordinated with wildlife biologists (Glacier National Park, USFS, Montana Fish, Wildlife & Parks, Blackfeet Tribe) to minimize potential impacts to animals in the area.

Cumulative Effects on Fish and Wildlife

Evaluation of the potential cumulative effects on fish and wildlife indicates these would be short-term and minor, and include temporary displacement during piscicide treatment. This conclusion holds for species of special concern, in which temporary displacement would be the primary impact. Fish and some aquatic invertebrates would experience considerable mortality. Macroinvertebrates would recolonize through natural mechanisms. Reintroduction of westslope cutthroat trout would mitigate for the loss of the existing fishery. This project is consistent with the MOU for cutthroat trout conservation (MCTSC 2007) and FWP's statewide fisheries management plan (FWP 2013).

2.2 Human Environment

2.2.1 Noise and Electric Effects

6. Noise and Electric Effects	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Increases in existing noise levels?			X			6a
b. Exposure of people to nuisance noise levels?		X				
c. Creation of electrostatic or electromagnetic effects that could be detrimental to human health or property?		X				
d. Interference with radio or television reception?		X				

Comment 6a: Increases in Existing Noise Levels

The presence of humans and the use of a generator to disperse $KMnO_4$ would increase noise within the project area. Likewise, a helicopter transporting materials, equipment, and fish would increase noise levels. Noise from the generator would attenuate rapidly a short distance from the fixed detoxification zone. Helicopter transfers would be of relatively short duration and would increase noise levels from 1 to 2 hours.

Cumulative Effects

The project would increase noise over a short duration. Helicopter use would entail several trips in to carry gear and fish and would last 1 to 2 hours per trip. The generator running the auger that distributes $KMnO_4$ would result in temporary and localized noise. We do not expect the proposed action to result in other actions that would create increased noise in the Hyde stream corridor. A separate treatment project may be proposed in the adjacent Box Creek drainage. If this project were to proceed, it would occur 1 to 2 years after the Hyde Creek project

2.2.2 Land Use

7. Land Use	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Alteration of or interference with the productivity or profitability of existing land use of an area?		X				7a
b. Conflict with a designated natural area or area with unusual or scientific importance?		X				
c. Conflict with any existing land use whose presence would constrain or potentially prohibit the proposed action?			X		No	7c
d. Adverse effects on, or relocation of, residences?						

Comment 7a: Conflicts with Existing Land Uses

This project would have an adverse effect on anglers seeking to harvest brook trout from Hyde Creek as current regulations allow harvest of 20 brook trout per day. In contrast, regulations for westslope cutthroat trout specify catch and release only. Anglers would continue to have the opportunity to harvest fish in the adjacent South Fork Two Medicine River with harvestable brook trout and rainbow trout, in addition to a number of other tributaries.

If the westslope cutthroat trout population in Hyde Creek were to reach harvestable levels, FWP would consider a change in regulations. Fishing pressure in this remote stream would be low, as it accessible only by horseback or hiking and would likely be able to handle the fishing pressure. No data on fishing pressure were available in FWP's database, confirming that the existing fishing pressure is low.

Profitability of grazing on national forest lands should not be affected. Some herding of cattle out of riparian areas may be necessary during the proposed piscicide applications. Current USFS livestock management plans would not be altered because of westslope cutthroat trout reintroduction efforts.

Comment 7c: Conflict with Existing Land Use

Hikers, equestrians, hunters, and anglers use the Hyde Creek trail. The proposed project would be completed midweek during early to late summer, likely mid-July to late August. This timing would minimize disturbance to hunters and other recreationalists who are more likely to use these trails on the weekends. At proposed treatment levels, stream water would not be toxic to wildlife or livestock. Nevertheless, to limit any potential conflict, the treatment would occur when livestock are in a different pasture or livestock would be temporarily moved to adjacent upland habitats or un-treated areas of Hyde Creek. Three permittees jointly use this allotment, which is broken into multiple pastures. The rotation system would allow for cattle to be away from the project area during treatment. These pastures are not controlled by fencing so some monitoring of cattle movement would likely be necessary.

Cumulative Effects
This project would have short-term and minor effects on land use including a potentially temporary change in angling regulations, presence of field crews that may be short-term nuisance to those seeking solitude, and potentially, minor changes in cattle occupation. This project would not result in any other alterations of land use in the Hyde Creek watershed.

2.2.3 Risks/Health Hazards

8. Risks/ Health Hazards	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Risk of an explosion or release of hazardous substances (including, but not limited to oil, pesticides, chemicals, or radiation) in the event of an accident of other forms of disruption?			X			8a
b. Affect an existing emergency response or emergency evacuation plan or create a need for a new plan?			X			8b
c. Creation of any human health hazard or potential hazard?			X			See 8a and 8c
d. Would any chemical piscicides be used?			X			8a

Comment 8a: Risk of Explosion of Release or Hazardous Substances
Fieldworkers applying piscicide would have the principal risk relating to exposure to hazardous materials. Following the exposure controls and other protective measures detailed in the MSDSs would result in protection of the safety and health of applicators. Protective gear and equipment include the use of respirators when using undiluted CFT Legumine. All applicators would wear personal protective equipment as required by label instructions.

The $KMnO_4$ applicators would also require protective clothing and gear to control exposure. Personal protection required in the MSDS includes gloves, splash goggles, synthetic apron, and vapor and dust respirator. In addition, $KMnO_4$ can explode when in contact with organic or other readily oxidizable substances. Applicators would ensure $KMnO_4$ is not exposed to these substances.

Field application would occur under the supervision of at least one, but most likely several licensed pesticide applicators. All individuals handling or applying chemical would receive training before the treatment. Materials would be transported, handled, applied, and stored according to the label specifications

Comment 8b: Affect an Existing Emergency Response Plan.

FWP requires a treatment plan for rotenone projects. This plan addresses many aspects of safety for people who are on the implementation team such as establishing a clear chain of command, training, delegation and assignment of responsibility, clear lines of communication among members, spill contingency plans, first aid, emergency responder information, personal protective equipment, monitoring and quality control. Implementing this project should not require modifications of existing emergency plans. Because FWP has developed an implementation plan, the risk of the need for an emergency response is minimal and any effects on existing emergency responders would be short-term and minor.

Comment 8c: Creation of any Human Health Hazard

Risks to human health relate to exposure to rotenone, the inert ingredients in the CFT Legumine formulation, or $KMnO_4$ used in detoxifying rotenone. Information examined here includes an analysis of human health risks relating to rotenone exposure (EPA 2007), MSDS sheets for chemicals used, and an evaluation of the chemical constitution of the CFT Legumine formula (Fisher 2007).

Acute toxicity refers to the adverse effects of a substance from either a single exposure or multiple exposures in a short space of time. Rotenone ranks as having high acute toxicity through oral and inhalation routes of exposure, and low acute toxicity through exposure to skin (Table 7; EPA 2007). Examination of acute toxicity profiles compiled by the EPA (2007) indicates this high acute toxicity would be applicable to undiluted CFT Legumine, with median lethal doses for rats ranging from 39.5 mg/kg (ppm) for female rats, and 102 mg/kg (ppm) for male rats. In contrast, the proposed concentration for rotenone in surface water is 0.025 ppb to 0.05 ppb. Therefore, field applicators would take necessary precautions to prevent ingestion or inhalation of undiluted CFT Legumine to avoid exposure to toxic concentrations of rotenone. Using a liquid formulation as opposed to powder would reduce any risks associated with inhalation. Exposure to concentrations in surface water would not lead to toxicity, although only approved field personnel would be near the stream during treatment as an added protection.

Table 7: Toxicological endpoints for rotenone (EPA 2007).

Exposure Scenario	**Dose Used in Risk Assessment, Uncertainty Factor (UF)**	**Level of Concern for Risk Assessment**	**Study and Toxicological Effects**
Acute Dietary (females 13-49)	NOAEL = 15 mg/kg/day UF = 1000 aRfD = 15 mg/kg/day = 0.015 mg/kg/day 1000	Acute PAD = 0.015 mg/kg/day	Developmental toxicity study in mouse (MRID 00141707, 00145049) LOAEL = 24 mg/kg/day based on increased resorptions
Acute Dietary (all populations)	An appropriate endpoint attributable to a single dose was not identified in the available studies, including the developmental toxicity studies.		
Chronic Dietary (all populations)	NOAEL = 0.375 mg/kg/day UF = 1000 cRfD = 0.375 mg/kg/day = 0.0004 mg/kg/day 1000	Chronic PAD = 0.0004 mg/kg/day	Chronic/oncogenicity study in rat (MRID 00156739, 41657101) LOAEL = 1.9 mg/kg/day based on decreased body weight and food consumption in both males and females
Incidental Oral Short-term (1-30 days) Intermediate-term (1-6 months)	NOAEL = 0.5 mg/kg/day	Residential MOE = 1000	Reproductive toxicity study in rat (MRID 00141408) LOAEL = 2.4/3.0 mg/kg/day [M/F] based on decreased parental (male and female) body weight and body weight gain
Dermal Short-, Intermediate-, and Long-Term	NOAEL = 0.5 mg/kg/day 10% dermal absorption factor	Residential MOE = 1000 Worker MOE = 1000	Reproductive toxicity study in rat (MRID 00141408) LOAEL = 2.4/3.0 mg/kg/day
Inhalation Short-term (1-30 days) Intermediate-term (1-6 months)	NOAEL = 0.5 mg/kg/day 100% inhalation absorption factor	Residential MOE = 1000 Worker MOE = 1000	[M/F] based on decreased parental (male and female) body weight and body weight gain
Cancer (oral, dermal, inhalation)	Classification; No evidence of carcinogenicity		

UF = uncertainty factor, NOAEL = no observed adverse effect level, LOAEL = lowest observed adverse effect level, aPAD = acute population adjusted dose, cPAD = chronic population adjusted does, RfD = reference dose, MOE = margin of exposure, NA = Not Applicable

As rotenone degrades, it breaks down into degradation products including rotenoloids. The EPA considered the toxicity of these compounds, and determined that because of their structural similarities to rotenone, the degradation products are no more toxic than the parent compound.

Dietary risks considered threats to the subgroup “females 13-49 years old”, and examined exposure associated with consuming exposed fish and drinking treated surface water. In determining potential exposure from consuming fish, the EPA used maximum residues in fish tissue. The concentrations of residue considered were conservative, meaning they may have been an overestimate of the rotenone concentrations in muscle tissue, as they included non-edible tissues, where concentrations may be higher. The EPA concluded that acute dietary exposure estimates resulted in a dietary risk below the EPA’s level of concern; therefore, consumption of fish killed by rotenone does not present an acute risk to the sensitive subgroup.

The EPA considered chronic dietary risks relating to exposure through drinking water. Chronic exposure from consuming exposed fish was not evaluated, given rotenone’s rapid degradation and low propensity to bioaccumulate in fish. Based on the chronic toxicity endpoint, the drinking water level of concern was 40 ppb (µg/L), which addressed effects on infants and children, the most sensitive population subgroup. The effective concentration for fish eradication is 0.025 ppb to 0.05 ppb.

In evaluating the potential for chronic exposure to rotenone, the EPA acknowledged the rapid degradation of rotenone in the environment, and that expediting deactivation with oxidizing agents, such as $KMnO_4$, was a standard procedure in many projects. The EPA concluded that no chronic exposures to rotenone would occur where water is treated with $KMnO_4$ or subject to an oxidative water treatment regime. They further concluded that persistence of chronic or sub-chronic exposures to 40 ppb for several weeks was limited to specific circumstances, such as drinking water intakes in cold-water lakes where no oxidative water treatment occurred. In Hyde Creek, treatment with $KMnO_4$ and natural breakdown would not present a risk to infants and children. Moreover, these surface flows are not used for domestic water sources, so potential for humans to consume treated water is exceptionally low.

The EPA estimated recreational risks associated with swimming, which would entail skin contact and incidental ingestion. The effective concentration of rotenone within Hyde Creek would be considerably lower than thresholds for dermal contact or incidental ingestion. Nonetheless, signs at access points would alert recreationist to the presence of rotenone for the 3 to 4 days of treatment and restrictions on public access to the stream would provide an additional safety measure.

An aggregate risk is the combined risk from dietary exposure and non-occupational sources, such as residential and recreational exposure. In its evaluation of the aggregate risk, the EPA combined the risk of eating treated fish and drinking treated water, and concluded the risk does not exceed their level of concern. The EPA did not aggregate recreational risk with the dietary risk, as the dietary assessment is conservative, and recreational exposure would be intermittent and would not occur for the general population. Moreover, stream closings, detoxification, and project timing would minimize or eliminate the potential for recreational exposure.

Occupational risks relate to fieldworkers mixing and applying rotenone. The EPA (2007) calculated margins of exposure for handlers mixing and applying rotenone through various methods, and with varying levels of protective gear, from none, to use of gloves, respirators, and protective clothing. The proposed approaches for this project call for use of a liquid formula applied with drip stations or backpack sprayer of seeps, springs, and backwaters (should they occur). Dough balls with powdered rotenone may be used in some places. The margins of exposures for these applications are below the level of concern with the use of gloves. Requiring protective eyewear, protective clothing, and respirators for applicators mixing rotenone would be highly protective of the health of applicators in the field.

The proposed formula for this project is CFT Legumine, which contains 5% rotenone, and 95% inert ingredients. Fisher (2007) evaluated the chemical composition of the inert fraction, the persistence of these constituents, and the potential to have an effect on human health and the environment. Comment 2a: Alterations in Water Quality (see page 20) details these findings. In general, the inert ingredients do not pose a threat to human health given their low toxicity and short period of persistence in the environment.

A recent study linked the use of rotenone and paraquat with the development of Parkinson's disease (PD) in humans later in life (Tanner et al. 2011). The after the fact study included mostly farmers from 2 states within the United States who presumably used rotenone for terrestrial application to crops and/or livestock. Rotenone is no longer approved for agricultural uses and is only approved for aquatic application as a piscicide.

The results of epidemiological studies of pesticide exposure are highly variable (Guenther et al. 2011). A series of studies have found no correlations between pesticide exposure and PD (Jiménez-Jiménez et al.1992; Hertzman 1994; Engel et al. 2001; Firestone et al. 2010). In contrast, some have found correlations between pesticide exposure and PD (Hubble et al. 1993; Lai et al. 2002; Tanner et al. 2011) and some have found it difficult determine which pesticide or pesticide class is implicated if associations with PD occur (Engel et al. 2001; Tanner et al. 2009). Criticisms of epidemiological studies linking pesticide exposure to PD relate to the high variation among study results, generic categorization of pesticide exposure scenarios, questionnaire subjectivity, and the difficulty in evaluating the causal factors in the complex disease of PD, which may have multiple causal factors, such age, genetics, or environment (Raffaele et al. 2011).

A specific concern is the inability to assess the degree of exposure to certain chemicals, including rotenone, particularly the concentration of the chemical, frequency of use, application, specific use, and exposure routes (Raffaele et al. 2011). Tanner et al. (2011) provides no information on formulation of rotenone used (powder or liquid) or the frequency or dose farmers were exposed to during their careers. This study also lacks data on the personal protective equipment used or any information about other pesticides farmers were exposed to during the period of the study is available. Without information on how much rotenone individuals were exposed to and for how long, evaluating the potential risk to humans of developing Parkinson's disease from aquatic applications of rotenone products is difficult.

An exhaustive review of the risks to human health of rotenone use as a piscicide concluded the following: "To date, there are no published studies that conclusively link exposure to rotenone and the development of clinically diagnosed PD. Some correlation studies have found a higher incidence of PD with exposure to pesticides among other factors, and some have not. It is very important to note that in case-control correlation studies, causal relationships cannot be assumed and some associations identified in odds-ratio analyses may be chance associations. Only one study (Tanner et al. 2011) found an association between rotenone and paraquat use and PD in agricultural workers, primarily farmers. However, differences between the methods of application, formulation, and doses of rotenone used in agriculture and residential settings are substantially different compared with aquatic use as a piscicide. Moreover, the agricultural workers interviewed were also exposed to many other pesticides during their careers, whereas fish biologists have episodic exposure. Through the EPA re-registration process of rotenone, occupational exposure risk is minimized by: new requirements that state handlers may only apply rotenone at less than the maximum treatment concentrations (200 ppb), the development of engineering controls to some of the rotenone dispensing equipment, and requiring handlers to wear specific PPE" (Guenther et al. 2011).

Clearly, reducing or eliminating risks to human health, including any potential risk of developing Parkinson's disease, public exposure to rotenone treated water must be eliminated to the extent possible. To reduce the potential for exposure of the public during the proposed use of CFT Legumine to restore westslope cutthroat trout, areas treated with rotenone would be closed to public access during the treatment. Signs would be placed at access points informing the public of the closure and the presence rotenone treated waters. Personnel would be onsite to inform the public and escort them from the treatment area should they enter. Rotenone treated waters would be contained to the proposed treatment areas by over 1 mile of dry channel and if necessary, adding $KMnO_4$ to the stream at the downstream end of the treatment reach, either at the fish barrier or downstream where the stream re-surfaces. $KMnO_4$ would neutralize any remaining rotenone before leaving the project area. The efficacy of the neutralization would be monitored using fish, which are extremely sensitive species to the chemical and a hand held chlorine meter. Therefore, the potential for public exposure to rotenone treated waters is minimal. The potential for exposure would be greatest for those government workers applying the chemical. To reduce their exposure, all CFT Legumine label mandates for personal protective equipment would be adhered to (see Comment 8a).

Finally, a description of the traditional uses of rotenone by native people is informative in evaluating its potential for creating hazards to human health. Native Brazilians have considerable exposure to rotenone through their use of this piscicide as a means to obtain fish for consumption (Teixera et al. 1984). They extract rotenone from the roots of the *Timbo* plant, and distribute the pulp by swimming into fish-bearing waters. Despite this high level of dermal and dietary exposure to rotenone, no harmful effects were apparent from this centuries old practice. Moreover, in contrast to the use of rotenone in fisheries management programs, the traditional method of applying rotenone from root does not involve the use of personal protective equipment or label required safety precautions. a

Cumulative Effects

Several actions would reduce the risks on human health. First, applicators handling the liquid rotenone formulation or $KMnO_4$ would follow all label instructions, including adhering to label requirements for concentration applied and the use of protective gear. An emergency plan would limit any risks associated with spills or exposure to chemicals. Detoxifying the rotenone with $KMnO_4$ would limit the spatial scope of the treated water. Fieldworkers operating drip stations would use protective gear such as eye protection and protective gloves. Posting signs alerting recreationalists about the project, and instructing them to avoid contact with the water, or drinking the water, would decrease the miniscule risk associated with dermal exposure or consumption.

2.2.4 Community Impact

9. Land Use	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Alteration of or interference with the productivity or profitability of existing land use of an area?		X				
b. Conflict with a designated natural area or area with unusual or scientific importance?		X				
c. Conflict with any existing land use whose presence would constrain or potentially prohibit the proposed action?		X				
d. Adverse effects on, or relocation of, residences?		X				

2.2.5 Public Services/Taxes/Utilities

10. Public Services/Taxes/Utilities	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Will the proposed action have an effect upon or result in a need for new or altered governmental services in		X				10a

any of the following areas: fire or police protection, schools, parks/recreational facilities, roads or other public maintenance, water supply, sewer or septic systems, solid waste disposal, health, or other governmental services? If any, specify: _______________						
b. Will the proposed action have an effect upon the local or state tax base and revenues?		X				10b
c. Will the proposed action result in a need for new facilities or substantial alterations of any of the following utilities: electric power, natural gas, other fuel supply or distribution systems, or communications?		X				
d. Will the proposed action result in increased used of any energy source?		X				
e. Define projected revenue sources		X				
f. Define projected maintenance costs		X				

Comment 10a and 10b:

This project would not result in a need for new or altered governmental services or increase taxes for the construction or maintenance. Much of the expense for the project comes from competitive grants earmarked for fish conservation. The labor involved by agency personnel is part of job description of existing employees.

Not proceeding with the project would increase justification for federal government involvement in fish conservation. Lawsuits are likely, especially if FWP is unable to meet its conservation goals for westslope cutthroat trout. The result could be including westslope cutthroat trout for protection under the Endangered Species Act. Listing westslope cutthroat trout would reduce the flexibility landowners have in managing their properties and agricultural operations. Moreover, the federal government would likely need to hire additional personnel to manage conservation and restoration of westslope cutthroat trout, which is ultimately an expense born by the public. For the most part, FWP is self-funded through license fees and other hunting and fishing related fees.

2.2.6 Aesthetics and Recreation

11. Aesthetics and Recreation	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Alteration of any scenic vista or creation of an aesthetically offensive site or effect that is open to public		X				

view?						
b. Alteration of the aesthetic character of a community or neighborhood?		X				
c. Alteration of the quality or quantity of recreational/tourism opportunities and settings? (Attach Tourism Report)			X		Yes	11c
d. Will any designated or proposed wild or scenic rivers, trails or wilderness areas be impacted? (Also see 11a, 11c)		X				

Comment 11c: Alteration of the Quality or Quantity of Recreational/Tourism Opportunities and Settings.

This project would result in temporary loss of angling opportunity in upper Hyde Creek from the time of fish removal and for several years after fish stocking. Note that fishing pressure is exceptionally low as evidenced by a lack of angler use data for the stream. Hyde Creek would likely support a healthy population of westslope cutthroat trout within 5 years of project implementation. In most cases, cutthroat trout fisheries in streams are catch and release. After colonization of Hyde Creek, FWP would evaluate the population to determine if it can support some harvest of westslope cutthroat trout. Nonetheless, this project would provide anglers a rare opportunity to fish for non-hybridized westslope cutthroat trout on the east side of the Continental Divide.

Cumulative Effects

The cumulative effects of the piscicide component of this project would be a 4-year span of no to marginal fishing as the westslope cutthroat trout reestablish. Stocking adults and juveniles would expedite reestablishment and result in immediate fishing opportunities. Imprinting fry using incubators or eggs boxes would provide an additional means of augmenting the populations. Despite the delay in reestablishing population size, growth of the new westslope cutthroat trout would be substantial, as competition for forage would be reduced. As a result, anglers would have the opportunity to catch relatively large westslope cutthroat trout for a small stream within a few years.

2.2.7 Cultural/Historical Resources

12. Cultural and Historical Resources	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Would the proposed action result in:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Destruction or alteration of any site, structure or object of prehistoric historic, or paleontological importance?		X				
b. Physical change that would affect unique cultural values?		X				
c. Effects on existing religious or		X				12c

sacred uses of a site or area?						
d. Will the project affect historic or cultural resources?		X				

Comment 12c: Effects on Existing Religious or Sacred Uses of a Site or Area.
The project site is located in the aboriginal range of several tribes. FWP sent a letter of consultation to their cultural officer on March 27, 2013. We will include any tribal concerns in the record of decision for this EA.

2.2.8 Summary Evaluation of Significance

13. Summary Evaluation of Significance	**Impact**				**Can Impact be Mitigated?**	**Comment Index**
Will the proposed action, considered as a whole:	**Unknown**	**None**	**Minor**	**Potentially Significant**		
a. Have impacts that are individually limited, but cumulatively considerable? (A project or program may result in impacts on two or more separate resources which create a significant effect when considered together or in total.)		X				
b. Involve potential risks or adverse effects which are uncertain but extremely hazardous if they were to occur?		X				
c. Potentially conflict with the substantive requirements of any local, state, or federal law, regulation, standard or formal plan?		X				
d. Establish a precedent or likelihood that future actions with significant environmental impacts will be proposed?		X				13d
e. Generate substantial debate or controversy about the nature of the impacts that would be created?	X	X			Yes	13e
f. Is the project expected to have organized opposition or generate substantial public controversy? (Also see 13e)	X	X				13f
g. List any federal or state permits required.						13g

Comment 13d: Establish a Precedent or Likelihood of Future Actions
This project does not establish a precedent or likelihood that additional projects with significant environmental projects would be proposed. Nonetheless, the recent *Statewide Fisheries Management Plan* (FWP 2013) specifies a goal of restoring westslope cutthroat trout to 20% of historically occupied habitat, so the neighboring Box Creek drainage is under consideration for a

similar project. Approval of this plan would not have bearing on any other related project and the Box Creek project would go through its own environmental assessment. No other brook trout removal projects are under consideration for the South Fork Two Medicine River drainage. The success of failure of other westslope cutthroat trout would not bear on the success or failure of this proposed action.

Comments 13e and f: Generate Debate, Controversy, or Organized Opposition
FWP and its conservation partners execute several piscicide projects every year and the public response is variable. Often projects receive little response. In other cases, native trout supporters provide enthusiastic support. Several high profile projects were the subject of substantial opposition. The level of support, controversy, or debate that this project would inspire is unknown. Educating the public on the value of native fish and the need for piscicides as a tool to meet conservation goals in an affordable and timely manner would be a component of limiting opposition and debate. In addition, dispelling misconceptions on toxicity to nontarget organisms, the response of aquatic invertebrate populations to piscicide, and its fate and transport is a means to mitigate the potential for opposition.

Comment 13g: Necessary Federal or State Permits
Piscicide treatment requires a general permit for pesticide application (#MTG87000). FWP submitted a notice of intent to DEQ and received a letter of consent for piscicide application. DEQ issued a letter acknowledging the notice of intent on August 13, 2012 and issued a general permit for pesticide application to FWP.

3.0 ALTERNATIVES

Three alternatives received consideration during preparation of the environmental assessment. The proposed alternative (alternative 2) was evaluated in detail. The others received less consideration as they would not meet the fisheries conservation or agricultural preservation goals.

3.1 Alternative 1: No Action

The no action alternative would result in continuation of the status quo and maintain the present angling quality and species diversity in Hyde Creek. The project area would continue to support brook trout. Reestablishment of a non-hybridized population would not happen and the risk of extinction of westslope cutthroat trout would continue.

3.2 Alternative 2: Proposed Action

The proposed action entails removing existing nonnative fish in upper Hyde Creek above a barrier waterfall and restocking the area with the nearest neighbor, non-hybridized westslope cutthroat trout. Release of $KMnO_4$ as an oxidizing agent would limit the spatial extent of the project area. Rocky Mountain tailed frogs have potential to be exposed to toxic concentrations of rotenone given their 3-year gilled phase. Capture of frogs, metamorphs, juveniles, and tadpoles before piscicide treatment would provide several year classes to repopulate Hyde Creek should more than the gilled phase be affected by rotenone.

The predicted benefits of alternative 2 are:

- The replication of an existing non-hybridized population of westslope cutthroat trout would bring considerable conservation benefit. Several potential source populations are under continued threat of extirpation from catastrophic events such as floods, fire, and disease, and genetic problems associated with small population size. Midvale Creek, one of the proposed donors is under imminent threat of genetic extinction. A transfer to Hyde Creek would help protect the genetic legacy of Midvale Creek.

- The project would result in the restoration or introduction of westslope cutthroat trout into approximately 6 miles of stream within the historic range of westslope cutthroat trout. This is consistent with the MCTSC's conservation objectives (MCTSC 2007) and FWP's statewide fisheries management plan (FWP 2013)

- Incremental step towards conservation goals may result in potential reduction of justification for the inclusion of westslope cutthroat trout for protection under the Endangered Species Act.

- This project would result in a rare opportunity to fish for one of Montana's native trout in a relatively remote location with a high potential for solitude.

3.3 Alternative 3: Mechanical Removal

Under this alternative, field crews would use electrofishing or other physical means to target nonnative fishes. The difficulty in achieving 100% removal is a primary deficiency in using mechanical removal as an option. The level of effort associated with even incomplete removal can be substantial. For example, FWP mechanically removed brook trout from a nearly four miles of Muskrat Creek (Shepard et al. 2001). During the four-year effort, fieldworkers captured nearly 5,400 brook trout and moved them below a barrier falls. By the end of the project, brook trout were still present above the barrier, and treatment with piscicide became the recommended alternative. Other researchers found five removals were required for successful elimination of rainbow trout from a stream in Tennessee (Kulp and Moore 2000); however, the stream length in this study was about 0.5 miles. In comparison, the Hyde Creek area is over 6 miles, including several tributaries in steep, remote, mountainous terrain.

In some cases, mechanical removal did not remove all nonnative fish; however, the native species benefited from reduced competition associated with this suppression. In a stream in

Tennessee, electrofishing did not eliminate rainbow trout, although reduced numbers allowed brook trout to reestablish (Moore et al. 1983). Native cutthroat trout in a Wyoming stream displayed a similar response to mechanical removal of brook trout (Thompson and Rahel 1996). The positive response of native trout is likely temporary, as remaining nonnatives will eventually rebound and exert the same competitive pressures on native species.

In the case of Hyde Creek, incomplete removal of nonnatives would not meet project objectives. Notably, brook trout can quickly displace native cutthroat trout, especially in higher elevations streams. Few brook trout are necessary for explosive population growth of this highly competitive species.

In summary, mechanical removal of nonnatives would not result in attainment of project objective, and would entail considerable expense. The likelihood of removing 100% of nonnatives along more than 6 miles of stream in this rugged country is exceedingly low. Furthermore, mechanical removal would require the commitment of considerable time, labor, and resources to the project, and would extend the duration of the removal portion to a minimum of 4 to 5 years. Likewise, the remaining hybrids would continue to breed with the pure westslope cutthroat trout and brook trout would continue to exert competitive pressure on westslope cutthroat trout.

4.0 ENVIRONMENTAL ASSESSMENT CONCLUSION SECTION

4.1 Evaluation of Significance Criteria and Identification of the Need for an EIS

Evaluation of the potential effects on the physical and human environment in 2.0 ENVIRONMENTAL REVIEW provides the basis for determining the need for an environmental impact statement (EIS), which is a more rigorous evaluation of the potential impacts to human health and the environment from the proposed action. If evaluation of these significance criteria suggests the proposed action would result in significant impacts, an EIS would be required.

This environmental review demonstrates the impacts of the proposed project are not significant. All are short-term, minor, and can be mitigated. The proposed actions would benefit native westslope cutthroat trout and are consistent with the statewide fisheries plan (FWP 2013) and the cutthroat trout MOU (MCTSC 2007).

4.2 Level of Public Involvement

Several factors influence the appropriate level of public involvement for a given proposed action. Risks to human health, the environment, local economics, as well as the seriousness of the environmental issues are key considerations. This project will include a 30-day public comment period. The public will be informed of the potential project through press releases in local newspapers and through a notice on FWP's website (http://fwp.mt.gov/news/default.aspx). Should sufficient public interest arise, FWP will plan a public meeting(s) and will advertise through the same venues as described above. FWP will hold a public meeting if they receive 3 or more requests.

4.3 Public Comments

The public comment period will extend from November 15, 2013 to December 14, 2013

Send comments to:

Montana Fish, Wildlife & Parks
c/o Hyde Creek EA Comments
4600 Giant Springs Road
Great Falls, MT 59405
or

FWPHydeComments@mt.gov

4.4 Parties Responsible for Preparation of the EA

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